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VOLUME 2 - SAN

Operation

DOMINIC

FISH BOWL SERIES

PROJECT OFFICERS REPORT—PROJECT 6.13

RF MEASUREMENTS AND OPTICAL MEASUREMENTS,
SHOT STAR FISH PRIME

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Army Missile Command
Redstone Arsenal, Alabama

and personnel of:

Radio Corporation of America
Missile and Surface Radar Division
Moorestown, New Jersey

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DEPARTMENT OF DEFENSE
WASHINGTON, D. C. 20301

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PREFACE

The reduction and compilation of the data presented in Part 2 are joint efforts. The efforts of Mr. C. Vaugh and Mr. R. Aldrich, who determined the major portions of fireball growth and altitude data, are particularly mentioned.

In addition, acknowledgement is made of the many helpful suggestions contributed by Dr. S. Stone of Los Alamos Scientific Laboratory. Without him, pretest predictions would have been difficult.

The XR triple-layer film was furnished and processed through the generosity of Edgerton, Germeshausen, and Grier, specifically Charles W. Wyckoff. Its performance exceeded the anticipations, and considerable data were obtained from the record.



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PART 1

RF MEASUREMENTS 

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CHAPTER 1

OBJECTIVES AND OPERATIONAL DESCRIPTION

1.1 OBJECTIVES

The primary DAMP Star Fish Prime objective was the measurement of C-band angular jitter. A total of nine rockets, equipped with DAMP C-band beacons, was originally scheduled for launch during the Star Fish Prime event. However, the toll of probes taken during the previous aborts in the Fish Bowl series, the desire to reserve several probe missiles for training to achieve reliable acquisition procedures, and the requirement for a probe control flight in a non-nuclear environment necessitated reserving the two late-time Speedball rockets originally scheduled for Star Fish Prime (probes 8 and 9) for test firings between Star Fish Prime and Blue Gill Triple Prime.

Of the seven resulting DAMP C-band rockets fired, three were Speedballs. The other four rockets were launched by projects 9.1a, 6.2, and 6.7. A list of firing times, projects, and tracked intervals is provided in the trajectory section of this report.

An operator error involving power programming prohibited acquisition of the project 6.7 rocket. Since it was



of paramount importance to have a tracked target in the air at burst time, the Speedball backup was fired at H-50 seconds, and no further attempts were made to acquire the 6.7 rocket. Of the remaining six rockets fired, all were tracked for most of their flight, with the exception of the H-50 second Speedball, which was lost shortly after burst and never re-acquired.

All Speedball rockets were equipped with Daisy flares. This flare package was designed to measure the target RF optical bias by ejecting intense flares which would enable comparison of the radar line of sight to the rocket with the optical position. However, due to complete overcast at the DAMP ship position, no flares were seen during Star Fish Prime.

Three radars were used for clutter and fireball reflection measurements. These were the second C-band tracker, the UHF and the L-band radars. The UHF and L-band frequencies were radiated from the same 28-foot parabolic antenna. The C-band tracker used was the Starboard 16-foot FPQ-4. The shipboard digital computer was used to program the C-band tracker through a series of eight different regions of antenna directions, with combinations of five

different scan patterns, with the UHF/L-band system slaved to the C-band tracker.

Possible interference with the destruct mechanism of the warhead prevented the UHF/L-band system from observing burst at H-0. Auroral-type clutter measurements, however, were obtained after H + 1 minute. UHF interference may have invalidated the radiometric measurements.

In addition to these objectives, the Thor booster was skin-tracked to burnout, and the composite telemetry and signal strength of the 246.3-Mc Thor health link was recorded. Riometer data was recorded for project 6.8 during the entire Fish Bowl series. Transit measurements are presented in Volume 7.

1.2 OPERATIONAL PARAMETERS

Date 9 July 1962

Time 0900; 09.0290 GMT

Altitude 400.15 km.

Yield 1.4 Mt

Position of burst with respect to Johnston Island

33.34-km ground range

200.31 degrees azimuth

Carrier vehicle Thor

Ships position at H-0

360 km from Johnston

Azimuth from Johnston = 10.3 degrees

Geodetic Latitude: 19.91 degrees N

Longitude: 168.91 degrees W

Ship's Maneuvers

10 degrees heading at H-33 min, 10 knots

Turn to Starboard at H-24 min, arriving at 330 degrees
at H-17 min

Turn to Starboard at H-700 sec, arriving 280 degrees
at H-340 sec

280 degrees heading at 4 knots until H+50 min

Turn to starboard to 100 degrees at H+50 min

Total probes, DAMP ship

C-band track: eight

Flare pack probe = four

Telemetry track = one (Thor)

1.3 FREQUENCY SUMMARY

C-band tracker 1 (Port)

Interrogate	5700 Mc
Receive	5775 - beacon
	5700 - skin

C-band tracker, 2 (Starboard)

Transmit	5795 Mc
Receive	5795 Mc
L-band radar	1300 Mc
UHF radar	430 Mc
Telemetry tracker	246.3 (Thor booster)
Radiometer	442 Mc
Riometer	30, 60, 120 Mc
Transit	400, 324, 150 Mc

1.4 DATA SUMMARY

For this report a separate data volume has been prepared for each Fish Bowl test in which the DAMP project was engaged (Star Fish Prime, Check Mate, Blue Gill Triple Prime, King Fish, and Tight Rope). It is the intent of each volume to present only the most pertinent and readily available data within the limited time scale available. Each test report volume contains less than 1 percent of the total recorded data accumulated during each mission, including calibrations.

Apologies must be presented for the lack of equipment block diagrams, sub-system parameters, calibration, and alignment procedures, etc. Equipment-related considerations are covered in detail in the following standard DAMP volumes:

1. System Function Manual (Equipment)
2. Equipment Operation Manual (Calibration, and Alignment procedures)
3. Data Processing Procedures Manual

The interested reader is referred to these documents for most questions concerning the nature of the equipment or the calibration methods.

Table 1.1 provides a tabulation of the various quantities recorded by each instrumentation system. The program followed by the port C-band radar is detailed in Table 1.2, and UHF/L-band slave intervals are given in Table 1.3.

TABLE 1.1 EQUIPMENT AND RECORDING DESCRIPTION

Type of Recording	Quantity Recorded	Speed of Recording
Digital (three recorders)	<ol style="list-style-type: none"> 1. Range, azimuth, elevation AGC voltage elevation error, azimuth error and range errors for tracking radars #1 and #2 2. Pitch, roll, ships heading for gyros No. 1 and No. 2 3. Azimuth, error, elevation error and AGC voltage for UHF/L-band radar 4. Azimuth, elevation and AGC voltage for telemetry tracker 5. Azimuth and elevation angles for slave pedestals No. 1, No. 3 and No. 4 6. Twenty-four bit real time and sync. pulses 	16 in/sec 100 samples per second per channel
Ampex (analog) (two recorders) Recorders #1 and #2	<ol style="list-style-type: none"> 1. AGC voltage, AUDAR, azimuth error, elevation error and range error for tracking radars No. 1 and No. 2 2. AGC voltage, azimuth error and elevation error for UHF/L-band radar 3. AGC voltage, azimuth error and elevation error for telemetry tracker 4. Audio commentary (operations net) 5. Tracking radar No. 1 analog range recorded on Ampex No. 1 6. Thirteen bit time and control track 	7½ in/sec
Sanborn (analog) (two recorders)	<ol style="list-style-type: none"> 1. AGC voltage for tracking radars No. 1 2. AGC voltage for UHF/L-band radar 3. Time 4. Tracking radar No. 1 analog range 5. Telemetry AGC 	10mm/sec
Video No. 1	<ol style="list-style-type: none"> 1. Reference and non-normalized bi-polar video from WDR 2. Audio commentary (operations net) 3. Time 	N/A

TABLE 1.1 (CONTINUED)

Type of Recording	Quantity Recorded	Speed of Recording
Video No. 2	<ol style="list-style-type: none"> 1. Reference, and non-normalized error and elevation error video signals from WDR receivers for tracking radar No. 2 2. Reference video from UHF/L-band radar 3. Audio commentary (operations net) 4. Time 	N/A
Boresight camera	<ol style="list-style-type: none"> 1. Tracking radar No. 2 (1000 ft reel) 2. Tracking radar No. 1 (400 ft reel) 	20 frames per second
Four channel audio recorder	<ol style="list-style-type: none"> 1. Commentary 	3-3/4 in/sec
X-Y plotter	<p><u>Probe 2 only</u></p> <ol style="list-style-type: none"> 1. X_g versus Y_g of tracking radar No. 1 2. R_g versus H of tracking radar No. 1 	N/A
Minicom video recorder	<ol style="list-style-type: none"> A. H-851 seconds to H-600 seconds: telemetry composite video cyclelock, 13 bit real time, and operations net commentary F. H-190 seconds to end of test: tracking radar No. 1 and No. 2 video, UHF/L-band radar video, 13 bit real time, and operations net commentary 	60 in/sec
Time and events recorders (brush strip chart - two recorders)	<ol style="list-style-type: none"> 1. switching events, 200 channels 	10mm/sec
Vidicon TV monitor	<ol style="list-style-type: none"> 1. Photographs during 6.13 probe flare firing sequences 	12 1/2 frames per sec
Events recorder (portable)	<ol style="list-style-type: none"> 1. Radiometer and radiometer events 	
Radiometer recordings	<ol style="list-style-type: none"> 1. Three AGC channels 2. Three audio channels 3. Time 	N/A
UHF radiometer	<ol style="list-style-type: none"> 1. UHF noise temperature 2. Time 	15 in/min
CEC/digital punch	<ol style="list-style-type: none"> 1. Transit print-outs of satellite passes 	N/A

TABLE 1.2 EDITED TIME AND EVENTS RECORD PORT C-BAND (RADAR NO. 1)

Time (H+sec)	GMT	Events	Notes
<u>Initial mission conditions</u>		MGC	Manual gain control
		External designate mode	The radar servos were directed by computers.
		285 PRF	Pulse repetition frequency
		1-microsecond pulse width	
		Receiver bandwidth 8 megacycles	
		Slave pedestal three unassigned	
		Boresight camera off	
		Azimuth bandwidth 3 cps	These figures refer to the three tracking servos.
		Elevation bandwidth 3 cps	
		Range bandwidth 4 cps	
	Beacon local oscillator on, MFC	Manual frequency control	
	Skin local oscillator	Status not recoverable from the raw time and events records for this mission	
-1754.4	08:30:54.6	Lockon automatic track mode, AGC	Start of probe 1 beacon track. Azimuth, elevation, and range servos commenced tracking the beacon return.
-1752.0	08:30:57	Slave pedestal 3 assigned to radar 1.	Slave pedestal 3 carried the vidicon camera
-1749.0	08:31:00	Beacon local oscillator, APC	Automatic frequency control
-1747.0	08:31:02	Receiver bandwidth 2 megacycles	
-1449.5	08:35:39.5	Manual mode, MGC	Azimuth, elevation, and range servos were now under the operator's manual control.
<u>Starting conditions probe 3</u>		Receiver bandwidth 8 megacycles	Only the changes from the last conditions above are noted.
		External designate mode	
		Boresight camera off	
		Beacon local oscillator, MFC	
		Slave pedestal 3 unassigned	

TABLE 1.2 (CONTINUED)

Time (H-sec)	GMT	Events	Notes
-30.0	08:59:38.7	Boresight camera on	
-14.0	08:59:55	Lockon automatic track mode, AGC	Start of probe 3 beacon track
+24.0	09:00:33	External designate mode, MGC	Radar designated by computers, disabling automatic track
		Receiver bandwidth 8 megacycles	
		Boresight camera off	
		Beacon local oscillator, MFC	
		Slave pedestal 3 unassigned	
781.3	09:13:10.3	Lockon automatic track mode	Start of probe 4 beacon track
		AGC	
784.0	09:13:13	Slave pedestal 3 assigned to radar 1	
793.1	09:13:14.1	Receiver bandwidth 2 megacycles	
797.5	09:13:26.5	Beacon local oscillator, AFC	
946.0	09:15:55	External designate mode, MGC	
		Receiver bandwidth 8 megacycles	
		Beacon local oscillator, MFC	
		Slave pedestal 3 unassigned	
124.9	09:21:40.9	Lockon automatic track mode	Start of probe 5 beacon track
		AGC	
1293.0	09:21:42.0	Slave pedestal 3 assigned to radar 1	
1294.6	09:21:43.6	Receiver bandwidth 2 megacycles	
1295.5	09:21:44.5	Beacon local oscillator, AFC	
1800.0	09:30:19	Slave pedestal 3 unassigned	
1800.3	09:30:19.3	Manual mode, MGC	
1813.5	09:30:22.5	External designate mode	
1817.9	09:30:26.9	Receiver bandwidth 8 megacycles	
1819.4	09:30:28.4	Beacon local oscillator, MFC	
1900.1	09:31:49.1	Lockon automatic track mode, AGC	Start of probe 6 beacon track

TABLE 1.2 (CONTINUED)

Time (H+sec)	GMT	Events	Notes
1901.2	09:31:50.2	Slave pedestal 3 assigned to radar 1	
1903.0	09:31:52	Beacon local oscillator, AFC	
1904.2	09:31:53.2	Receiver bandwidth 2 megacycles	
2142.7	09:35:51.7	External designate mode, MGC	Lost track; attempted to re-acquire
2143.4	09:35:52.4	Slave pedestal 3 unassigned	
2187.6	09:36:36.6	Lockon automatic track mode, AGC	Re-acquired probe 6
2189.0	09:36:38	Slave pedestal 3 assigned to radar 1	
2309.0	09:38:38	Slave pedestal 3 unassigned	
2309.5	09:38:38.5	Manual mode, MGC	
		Beacon local oscillator, MFC	
		Receiver bandwidth 8 megacycles	
		Lockon automatic track mode, AGC	Start of probe 7 track
2440.6	09:40:49.6	Receiver bandwidth 2 megacycles	
2442.1	09:40:51.1	Slave pedestal 3 assigned to radar 1	
2442.3	09:40:51.3	Beacon local oscillator, AFC	
2443.0	09:40:52	Slave pedestal 3 unassigned	
3285.0	09:54:54	Manual mode, MGC	
3286.2	09:54:55.2		

TABLE 1.3 UHF/L-BAND SLAVE INTERVALS,
SLAVED TO STARBOARD C-BAND RADAR NO. 2

From (H +, Sec)	To
81	116
133	166
183	218
235	289
309	362
378	431
447	566
597	715
730	806
820	after 900



CHAPTER 2

EQUIPMENT SUMMARY

The following equipment listings are intended to convey the important parameters of the various sensors and recorders contained on the DAMP ship applicable to the Fish Bowl measurement:

AN/FPQ-4 (2 each)	Tracking Radar
Antenna	16-foot parabolic reflector 46.9-db gain 4-horn monopulse feed 14-mil (=0.8 degree) beam-width (one way)
Repetition rate	142, 285, 855 pps
Pulse duration	1.7, 1.0, 0.25 μ sec
Receiver bandwidth	1.2 Mc, 2.2 Mc, 8 Mc
Noise figure	6 db
Frequency	C-band (5400 to 5900 Mc)
Peak power	3 megawatts
Pedestal	Azimuth-elevation mount
Track rates	Range 10k yds/sec Azimuth 720 mils/sec Elevation 400 mils/sec
Pedestal data output	Digital and synchros
Polarization	1 horizontal, 1 vertical For Fish Bowl tests, tracking radar is vertically polarized radar (Port radar).

Unambiguous range 1000 naut mi (TR 1 Port)
 500 naut mi (TR 2 Starboard)

2.1 L-BAND/UHF RADARS

The L-band and UHF radars, which share a common antenna, permit observation of the target by illumination other than C-band. These radars are not automatic tracking radars and are normally slaved to one of the AN/FPQ-4 tracking radars.

Antenna	28-foot reflector, paraboloid	
	Gain L-band	38.3 db
	UHF	29 db
	Beamwidth L-band	2 degrees
	UHF	6 degrees
	Polarization	vertical
	Sidelobes: UHF	14 db
	L-band	17 db
	<u>L-Band</u>	<u>UHF</u>
Range (1-m ² target, S/N = 1)	266 naut mi	204 naut mi
Repetition rates	285 pps	285 pps
Pulse duration	1.7 μsec	1.7 μsec
Receiver bandwidth	1.2 Mc	1.2 Mc
Noise figure	8 db	5 db
Frequency	1250 to 1350 Mc	406 to 450 Mc
Peak power	2 Mw	2 Mw
Pedestal	Modified 5-inch Mark 38 gun-mount on 10-foot tower	

Track rate	Slaved to AN/FPQ-4 radar
	Azimuth 0.43 radian/sec
	Elevation 0.25 radian/sec
Pedestal data:	Synchros
Travel:	Azimuth ± 135 degrees with respect to stern
	Elevation -50 degrees to +85 degrees with respect to deck

2.2 TELEMETRY TRACKER

The telemetry tracker is an acquisition aid operating on the interferometer principle which gives angular position of the telemetry target from the ship.

General characteristics include:

Purpose	Telemetry recording and acquisition vectoring
Antenna	12-foot-square ground plane with four antenna assemblies (Vought Electronics CVAT-162-4)
Frequency	215 to 260 Mc
Polarization	Vertical, horizontal, circular (left or right)
Gain	18 db
Receiver	Nems-Clark 1432
Beamwidth	20 degrees
Side-lobe level	-12 db
VSWR	1.5 maximum

Power capacity	200 watts (continuous)
Pedestal	Canoga Electronic Corporation Model 8417, modified by RCA
Tracking rates	Azimuth 10 degrees/sec Elevation 10 degrees/sec Slew 30 degrees/sec
Tracking receiver preamp threshold:	-160 dbw
Pedestal output	Synchros, digitally encoded
Discriminators	EMR 67-D

2.3 VIDICON

Objective lens: Wollensak 20-inch Mirrotel F16-3

Field of view: 2 degrees

Resolving power: 2 seconds of arc

Image converter: 3-stage, electrostatic focused.
RCA C-73491

TV monitor: TM - 9N (twin)

Cameras (2) flight: Research IV-C 30 frames/sec
35 mm

2.4 SLAVE PEDESTALS

Four modified Talos AN/FPW-2 guidance pedestals may be slaved to either or both of the AN/FPQ-4 tracking radars. Dynamic and other characteristics of these slave pedestals are as follows:

	<u>Azimuth</u>	<u>Elevation</u>
Travel	Unlimited	-10 to 180 degrees
Angular velocity maximum	15 rpm	6 rpm
Angular accelera- tion maximum	9 radians/sec ²	6 radians/sec ²
Data output	Synchros, digitally encoded	

2.5 RECORDERS

Operating parameters of the various recorders used in conjunction with the above equipment are given in Table 2.1.

TABLE 2.1 RECORDER TABULATION

Recorder	Channels	Normal Speed	Information Capacity per Channel	Length	Model
CEC Digital	48	16 inches/sec	100 samples/sec 24 bits/sample	45 minutes	CEC #P00504
Ampex	42	Direct and FM 7 1/2 inches/sec	10-1.5M 100-10-1M at 60 in/sec	25 minutes	FR-100B
Mincom Video	7	120 inches/sec	1.0 Mc	12 minutes	CM-100
RCA Video	2	Multiplexed	4 Mc	30 minutes	Special
Sanborn	38	1 cm/sec	low frequency		Sanborn 156-100 series
Time and Events	200	1 cm/sec		215 minutes	Brush, RE 3610 00
Audio	4	7 1/2 inches/sec	Audio	96 minutes	RCA Audio Tape Deck
Vidicon Cameras	2	10 1/2 frames/sec		20 minutes	Flight Research IV-C
Boresight Cameras	2	20 frames/sec		12 minutes	Flight Research IV-C
CEC, Digital Punch	4				
Chart Recorders	8	Variable	Low		Esterline Angus 43006

CHAPTER 3

TRACKING RADAR TRAJECTORY

3.1 INTRODUCTION

All trajectory data was reduced from raw digital tapes of range, azimuth, elevation, roll, pitch, and own ship's heading (OSH) according to the IBM 709 digital program outlined below. Although the raw data was obtained and is available at 100 points per second, it was reduced and is presented, for obvious reasons, at 1 point per second during periods of valid FPQ-4 automatic track.

The following launcher locations were assumed:

1. Star Fish: All rocket launchers

Latitude 16.7350° (GEOD.)

Longitude 169.5255°

This assumption was made since the expected error in all Star Fish Prime trajectory printouts is of the order of the dimensions of Johnston Island.

2. Check Mate, Blue Gill Triple Prime, and King Fish: 6.13 Probes longitude 169.5208° W

Latitude 16.7350° (GEOD.)

6.2 Probes longitude 169.5148° W

Latitude 16.7350° (GEOD.)

3. Tight Rope:

N-Hercules Longitude 169.5255° W

Latitude 16.7350° (GEOD.)

Firing azimuths listed were computed generally from the X- and Y-values near the last point of track. They are therefore not corrected for Coriolis force.

3.2 DESCRIPTION OF TRAJECTORY LISTING

The sequence of the listing (reading across from left to right is:

1. Time in seconds relative to H-time
2. Target range from ship, kilometers
3. Target azimuth with respect to true North, degrees
4. Target geodetic elevation, degrees

These four quantities are raw data referenced to the ship, obtained by removing the effects of raw recorded roll, pitch, and OSR data from the raw range and pedestal angle information.

The next eight quantities involve translation to the launcher position and require that the ship and launcher position be used in computation. These quantities are:

5. X-distance East relative to launcher, kilometers

6. Y-distance North, kilometers
7. Z-vertical at launcher site. kilometers
8. $\sqrt{X^2 + Y^2}$. kilometers
9. Height over surface of earth, kilofeet
10. Height over surface of earth, kilometers
11. Latitude of target (geodetic), degrees
12. Longitude of target, - degrees

The X - Y - Z coordinate system is therefore an orthogonal system tangent to the earth surface at the launcher.

At the end of each printed interval of track, a number of input parameters are printed out. These parameters are:

1st Line:

1. Code
2. Code
3. Code
4. Code
5. Ship heading, degrees true
6. Ship velocity, knots
7. Code

2nd Line:

8. Launcher latitude (geodetic), degrees
9. Launcher longitude, degrees

10. Launcher height, feet
11. Earth semi-major axis, feet
12. Earth semi-minor axis, feet

3rd Line:

13. Start latitude of ship, degrees
14. Start longitude of ship, degrees
15. Height of radar, feet
16. Starting time
17. Stopping time

4th Line:

18. Final latitude of ship, degrees
19. Final longitude of ship, degrees

No data printed for those portions of track below 3 degrees with respect to the DAMP ship is considered reliable. It is included only to establish a minimum time-of-flight and impact range.

3.3 DESCRIPTION OF TRAJECTORY PROGRAM

The following symbols and equations were used in the development of the trajectory program. The drawings in Figure 3.1 show the geometry of the problem and indicate the location of the symbols used.

- a Equatorial radius of the earth: 20,926,428 feet
- A_1 Angle measured positive clockwise from the Y-axis, in the X - X plane, to the projection of the target position vector in the X - Y plane (See A, Figure 3.1.)
- A_2 Same as A_1 but all references are made to the $X_e - Y_e - Z_e$ coordinate system rather than the X - Y - Z (See E, Figure 3.1.)
- b Polar radius of the earth: 20,855,968 feet
- E_1 Angle measured positive upward from the X - Y plane to the target position vector (See A, Figure 3.1.)
- E_2 Same as E_1 but referenced to the $X_e - Y_e - Z_e$ coordinate system rather than the X - Y - Z (See E, Figure 3.5.)
- h_1 Height above mean sea level of the sensor at position 1
- h_2 Height above mean sea level of the sensor at position 2
- h_t Height (geocentric) of the target above mean sea level

R_1 Radar range of the target from position 1
 R_2 Radar range of the target from position 2
 R_{E1} Radius of the earth at position 1
 R_{E2} Radius of the earth of position 2
 R_E Radius of the earth at position of the target
 α_1 Angle measured clockwise in the tangent plane
at position 1 from true North to the Y-axis
(See A, Figure 3.1.)
 α_2 Angle measured clockwise in the tangent plane
at position 2 from true North to the Y-axis
(See E, Figure 3.5.)
 λ_1 Longitude of position 1 (positive East)
 λ_2 Longitude of position 2 (positive East)
 λ_T Longitude of position of the target
(positive East)
 \emptyset_1 Geocentric latitude of position 1
(positive North)
 \emptyset_1^V Geodetic latitude of position 1
(positive North)
 \emptyset_2 Geocentric latitude of position 2
(positive North)
 \emptyset_2^V Geodetic latitude of position 2
(positive North)

θ_T Geocentric latitude of position of the
target (positive North)

θ_{TV} Geodetic latitude of position of the
target (positive North)

3.4 TRAJECTORY ACCURACY

A numerical estimate of typical tracking errors of the DAMP system was obtained (Reference 1) by comparison of seven spans of tracking data with Atlantic Missile Range (AMR) station 12 FPS-16 tracking data during six ICBM tests in the Ascension area in 1961. Station 12 data was assumed perfect. The tracking noise and bias errors in DAMP data (due to uncertainty in ship's position, and gyro noise and bias, including radar range, azimuth, and elevation errors) thus determined are presented in Table 3.1 for four of these spans. These four spans are considered to be more representative of the tracking geometry of the Fish Bowl DAMP tracking intervals since they are end-aspect shots (DAMP ship positioned downrange from impact). The other three tests were side-aspect shots involving high angular rates and cannot be considered pertinent.

To obtain the noise in the Johnston Island referenced portion of the listing, the noise estimate in Table 3.1 may be used

with the range, azimuth, and elevation data referenced to the ship. Caution must be used in applying any bias error estimates to the data referenced to Johnston Island or the earth (latitude, longitude, and altitude) in the trajectory listings included in Appendix A. Bias was removed in part by forcing the ship position, within limits, to make the X - Y portion of the trajectory meet at $X = 0$ and $Y = 0$. The bias errors tabulated in Table 3.1 are therefore pessimistic for the present purpose.

The transformation equations are as follows:

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} R_1 \cos E_1 \sin A_1 \\ R_1 \cos E_1 \cos A_1 \\ R_1 \sin E_1 \end{pmatrix}$$

(3.1)
See A,
Figure 3.1

$$\begin{pmatrix} x \\ y \\ z_1 \end{pmatrix} = \begin{pmatrix} \cos \alpha_1 & \sin \alpha_1 & 0 \\ -\sin \alpha_1 & \cos \alpha_1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix}$$

(3.2)
See A,
Figure 3.1

$$\begin{pmatrix} x \\ y \\ z_2 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos(\phi_1^V - \phi_1) & \sin(\phi_1^V - \phi_1) \\ 0 & -\sin(\phi_1^V - \phi_1) & \cos(\phi_1^V - \phi_1) \end{pmatrix} \begin{pmatrix} x \\ y \\ z_1 \end{pmatrix}$$

(3.3)
See B,
Figure 3.1

Where: $\phi_1 = \tan^{-1} \left\{ \left(\frac{b}{a} \right)^2 \tan \phi_1^V \right\}$

$$\begin{pmatrix} x \\ y \\ z_3 \end{pmatrix} = \begin{pmatrix} x \\ y \\ z_2 \end{pmatrix} + \begin{pmatrix} 0 \\ 0 \\ R_{E_1} + h_1 \end{pmatrix}$$

(3.4)
See B,
Figure 3.1

Where: $R_{E_1} = ab \left[(b \cos \phi_1)^2 + (a \sin \phi_1)^2 \right]^{-\frac{1}{2}}$

$$\begin{pmatrix} x \\ y \\ z_4 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos \phi_1 & \sin \phi_1 \\ 0 & -\sin \phi_1 & \cos \phi_1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z_3 \end{pmatrix}$$

(3.5)
See B,
Figure 3.1

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix}_5 = \begin{pmatrix} \cos(\lambda_2 - \lambda_1) & 0 & -\sin(\lambda_2 - \lambda_1) \\ 0 & 1 & 0 \\ \sin(\lambda_2 - \lambda_1) & 0 & \cos(\lambda_2 - \lambda_1) \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix}_4$$

(3.6)
See C,
Figure 3.1

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix}_6 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos \phi_2 & -\sin \phi_2 \\ 0 & \sin \phi_2 & \cos \phi_2 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix}_5$$

(3.7)
See L,
Figure 3.1

Where: $\phi_2 = \tan^{-1} \left\{ \left(\frac{b}{a} \right)^2 \tan \phi_2^V \right\}$

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix}_7 = \begin{pmatrix} x \\ y \\ z \end{pmatrix}_6 - \begin{pmatrix} 0 \\ 0 \\ RE_2 + h_2 \end{pmatrix}$$

(3.8)
See D,
Figure 3.1

Where: $RE_2 = ab \left[(b \cos \phi_2)^2 + (a \sin \phi_2)^2 \right]^{\frac{1}{2}}$

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix}_8 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos(\phi_2^V - \phi_2) & \sin(\phi_2^V - \phi_2) \\ 0 & -\sin(\phi_2^V - \phi_2) & \cos(\phi_2^V - \phi_2) \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix}_7$$

(3.9)
See D,
Figure 3.1

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix}_9 = \begin{pmatrix} -\sin \alpha_2 & \cos \alpha_2 & 0 \\ \cos \alpha_2 & \sin \alpha_2 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix}_8$$

(3.10)
See E,
Figure 3.1

See E, Figure 3.1, for all quantities defined by the following equations:

$$A_2 = \tan^{-1} \left\{ \frac{x_9}{y_9} \right\} \quad (3.11)$$

$$R_2 = \left[(x_9)^2 + (y_9)^2 + (z_9)^2 \right]^{\frac{1}{2}} \quad (3.12)$$

$$E_2 = \sin^{-1} \left\{ \frac{z_9}{R_2} \right\} \quad (3.13)$$

See F, Figure 3.1, for all quantities defined by the following equations:

$$\phi_T^v = \tan^{-1} \left\{ \left(\frac{a}{b} \right)^2 \tan \phi_T \right\} \quad (3.14)$$

$$\text{Where: } \phi_T = \tan^{-1} \left\{ y_4 \left[(x_4)^2 + (z_4)^2 \right]^{-\frac{1}{2}} \right\}$$

$$\lambda_T = \lambda_1 + \tan^{-1} \left\{ \frac{x_4}{z_4} \right\} \quad (3.15)$$

$$h_T = \left[(x_4)^2 + (y_4)^2 + (z_4)^2 \right]^{\frac{1}{2}} - R_{ET} \quad (3.16)$$

$$\text{Where: } R_{ET} = ab \left[(b \cos \phi_T)^2 + (a \sin \phi_T)^2 \right]^{-\frac{1}{2}}$$

The plan trajectories of the probes, the ship movement, and a general plan view of the Star Fish Prime geometry are shown in Figures 3.2 through 3.4. Figures 3.5 through 3.7 show the probe trajectories for Star Fish Prime.

TABLE 3.1 NUMERICAL ESTIMATE OF TYPICAL TRACKING ERRORS

Test	Geometry Aspects	Tracking Period	Tracking Differences											
			Azimuth				Elevation				Range			
			Mean	Std	RMS		Mean	Std	RMS		Mean	Std	RMS	
5462	End	sec 1802-1882	deg -0.287	deg 0.086	deg 0.300		deg -0.050	deg 0.056	deg 0.075		feet 7220	feet 1183	feet 7316	
3212	End	1882-1956	-0.055	0.047	0.072		0.067	0.064	0.093		2949	406	2978	
6203	End	1812-1904	0.063	0.285	0.292		0.169	0.074	0.184		-3733	411	3756	
6203	End	1888-1911	0.828	0.467	0.950		0.260	0.094	0.277		-4520	149	4522	

^aEnd aspect, ship position in trajectory plane downrange from impact point.

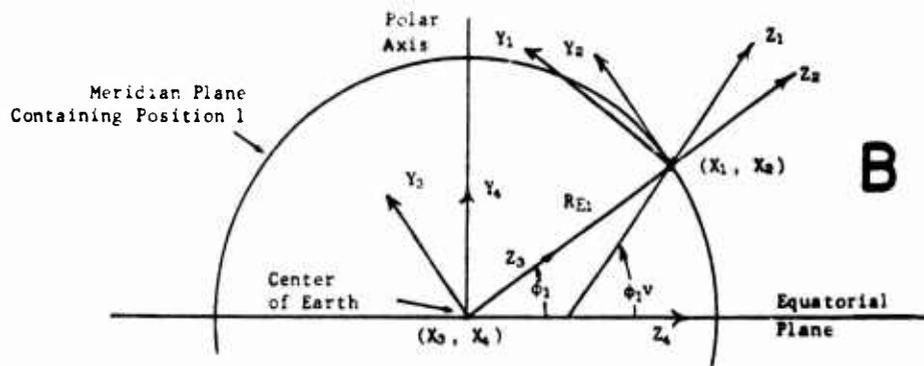
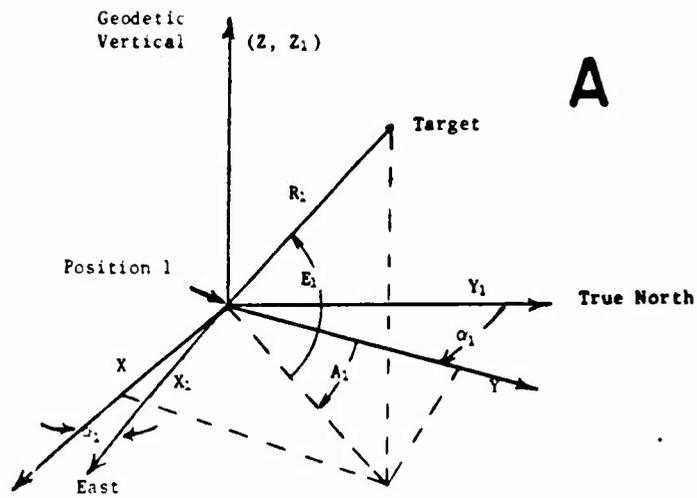


Figure 3.1 Geometrical figures used in derivation of trajectory equations.

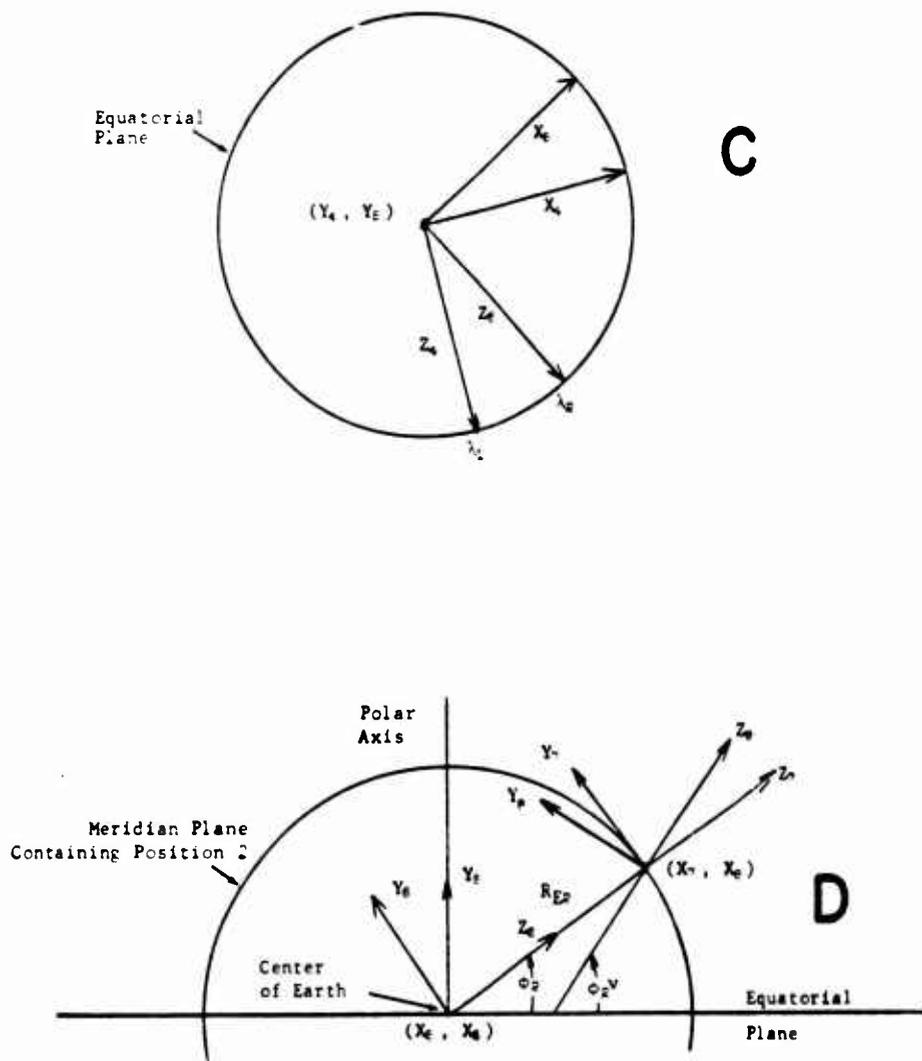


Figure 3.1 Continued

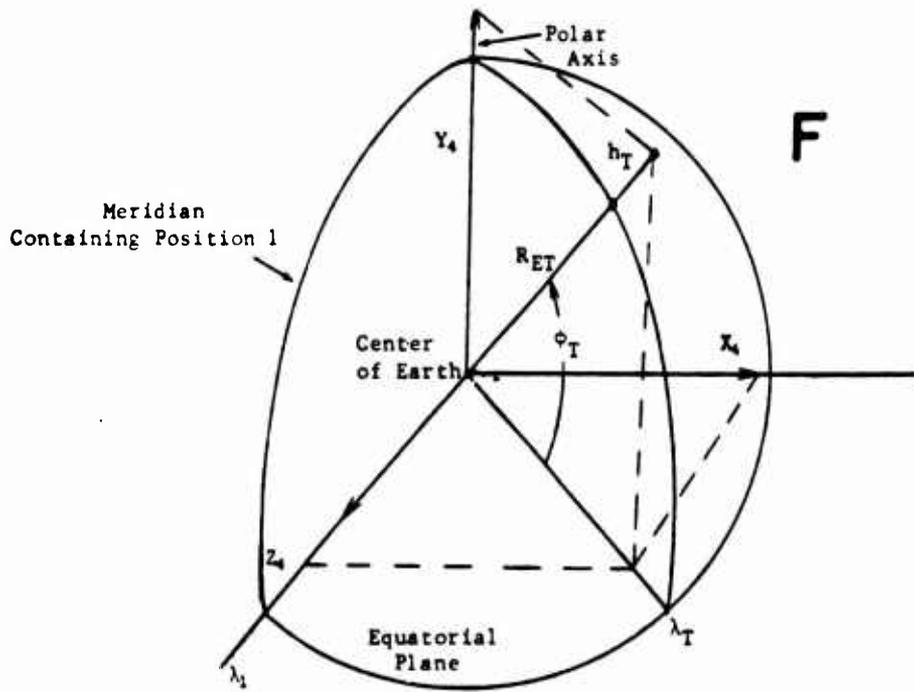
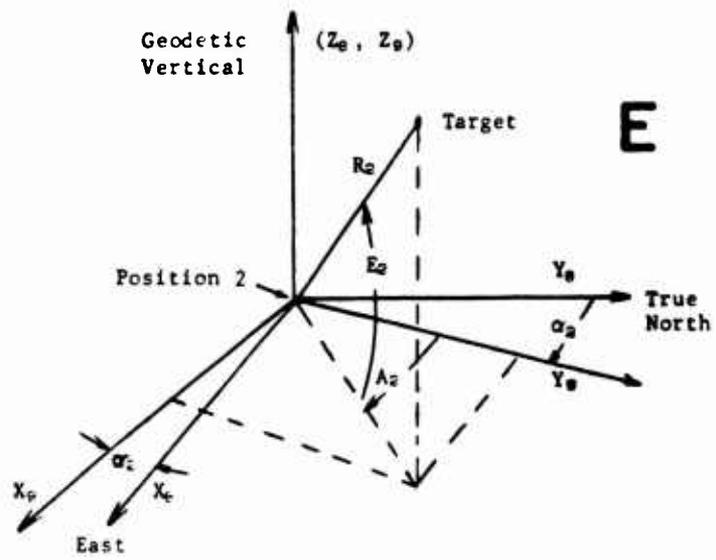


Figure 3.1 Continued

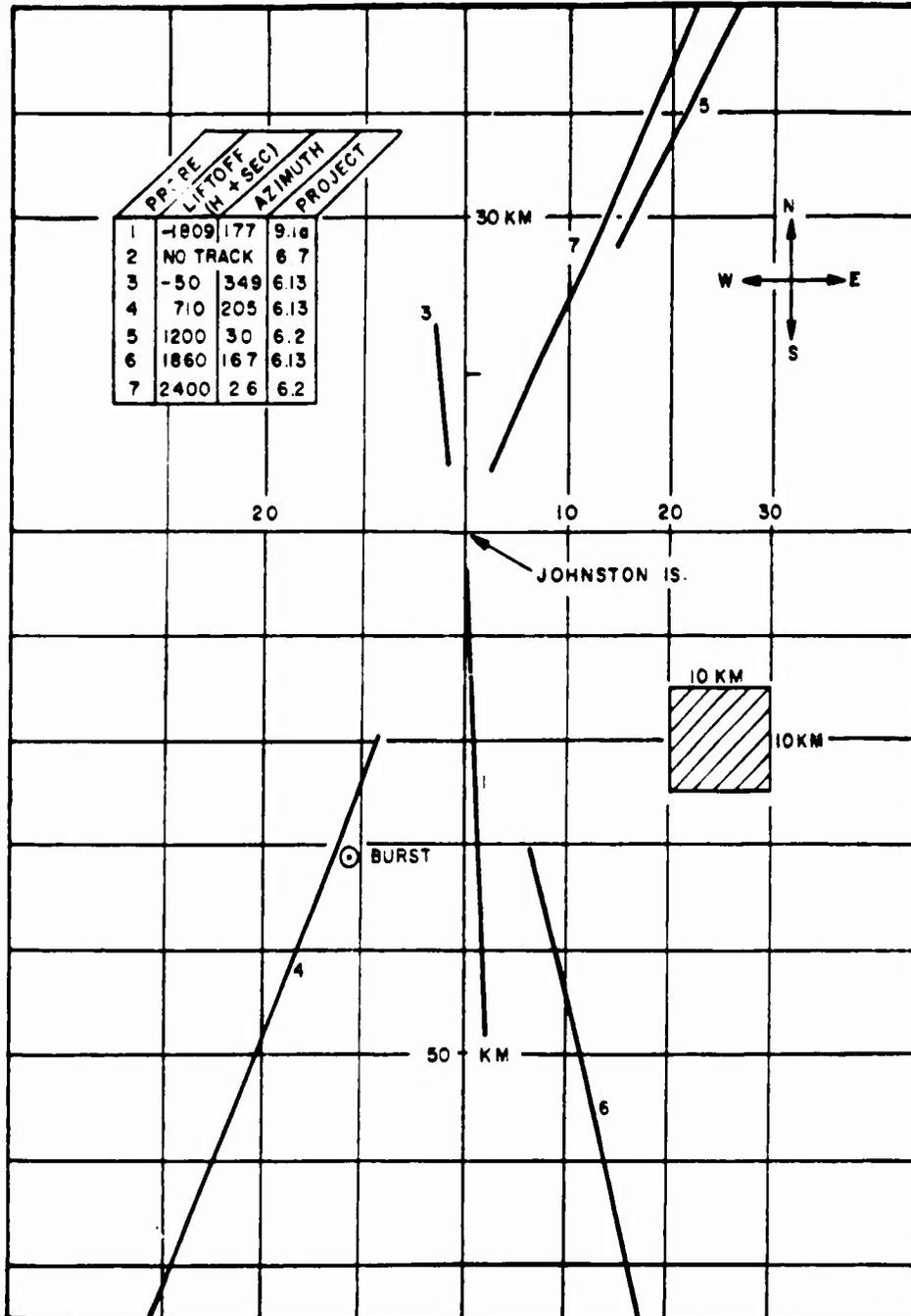


Figure 3.2 Star Fish Prime plan trajectories.

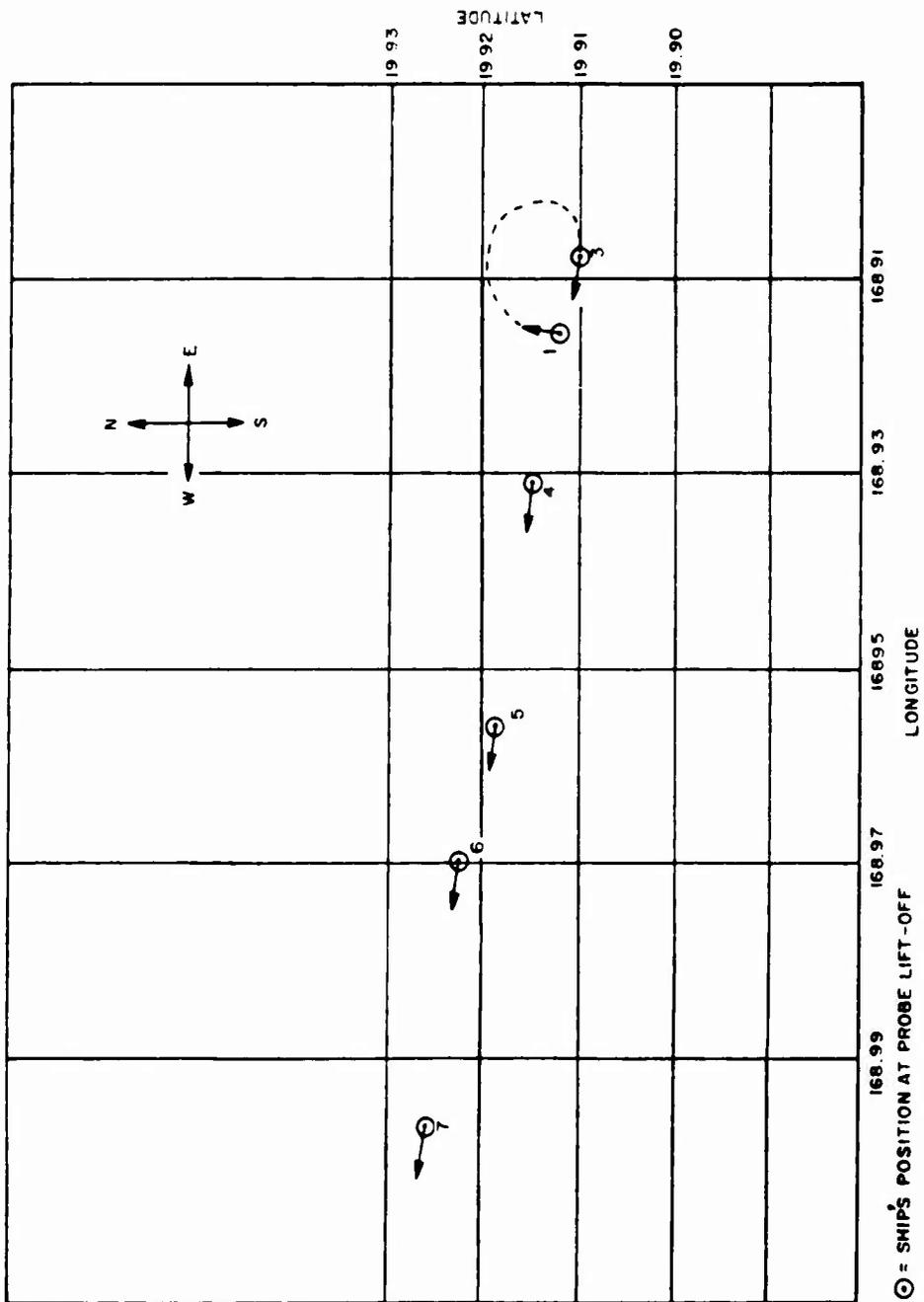


Figure 3.3 Star Fish Prime ship movement for six tracked probes.

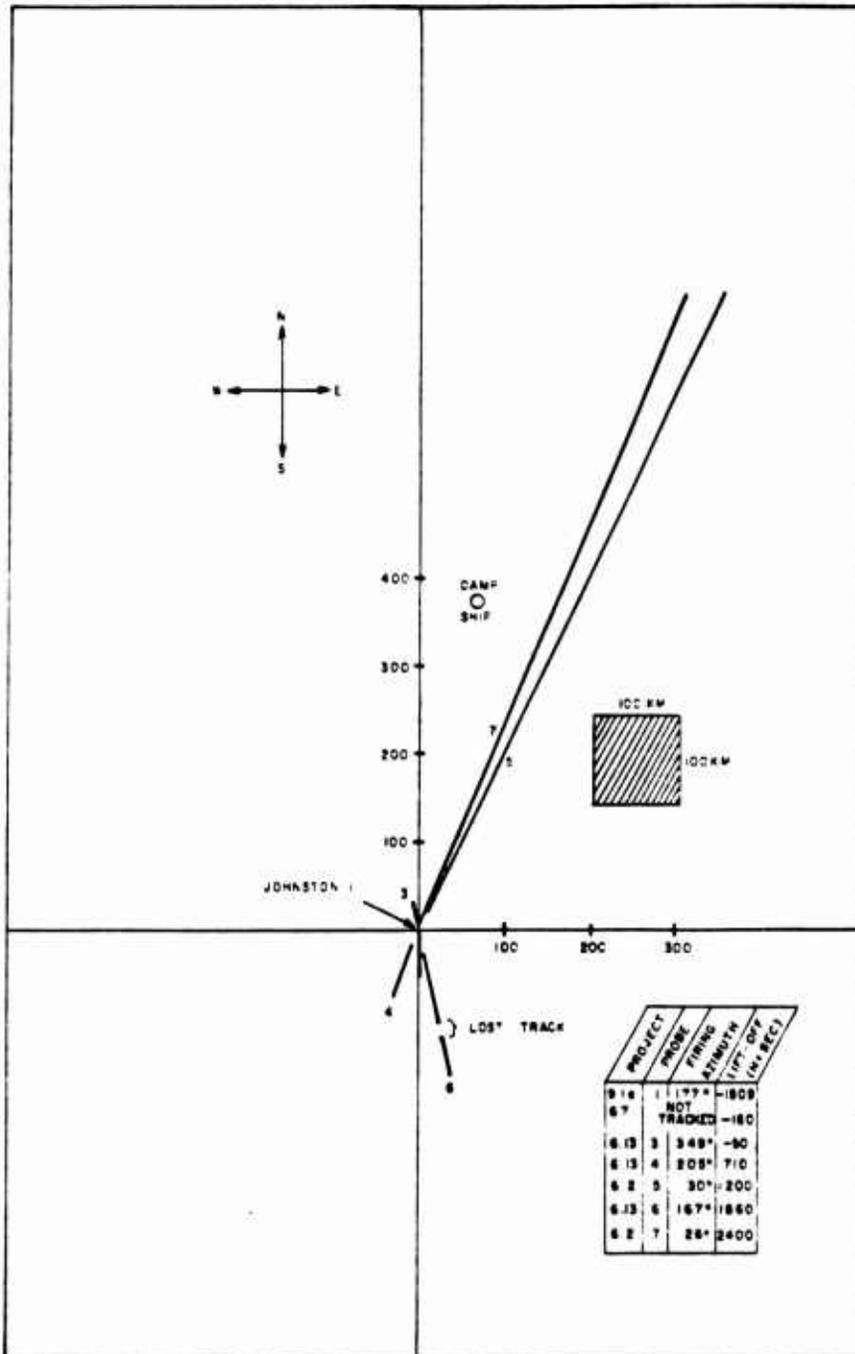


Figure 3.4 Star Fish Prime plan view.

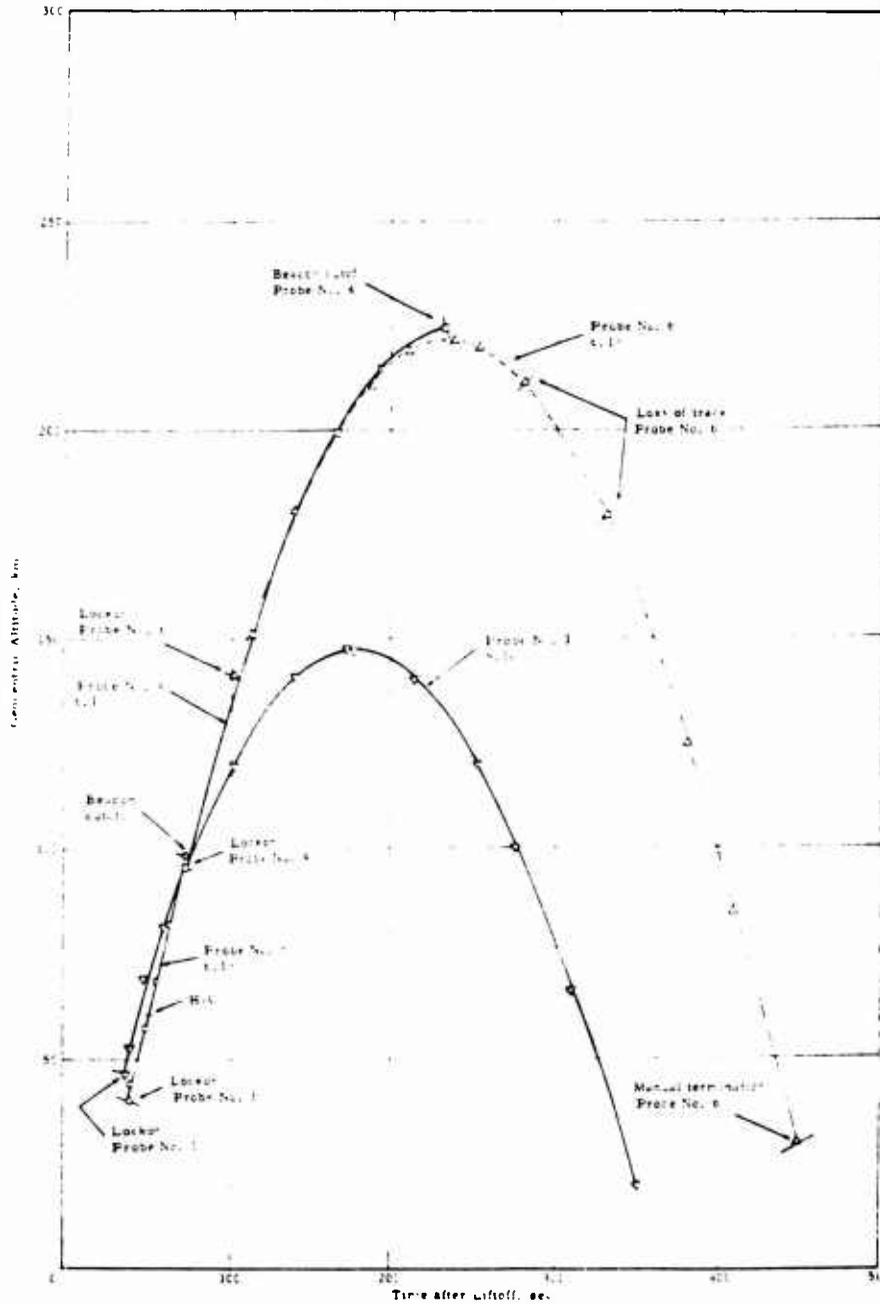


Figure 3.5 Star Fish Prime time-altitude trajectories, 6.13 and 9.1a probes.

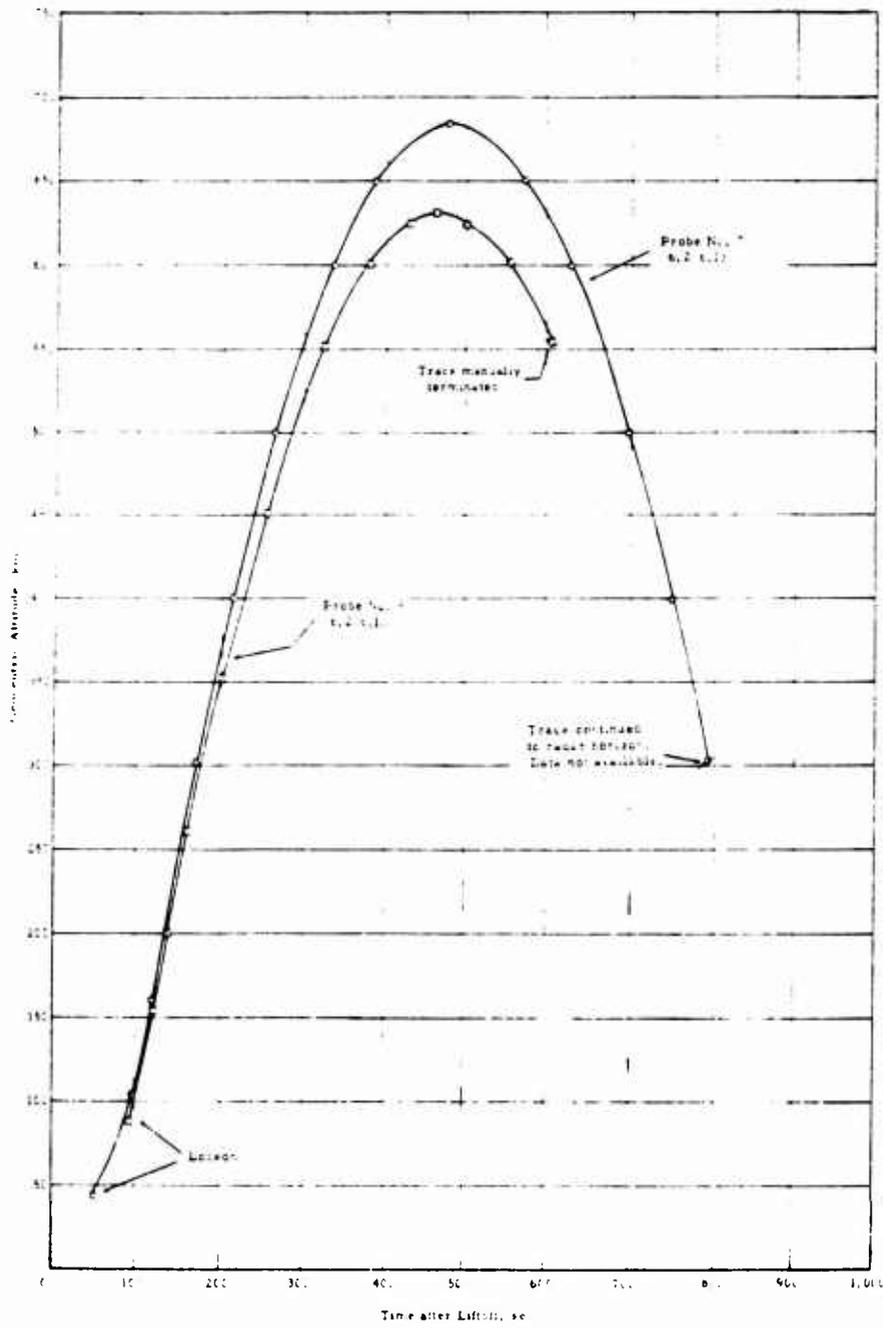
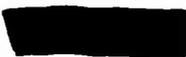


Figure 3.6 Star Fish Prime time-altitude trajectories, 6.2 and 6.13 probes.



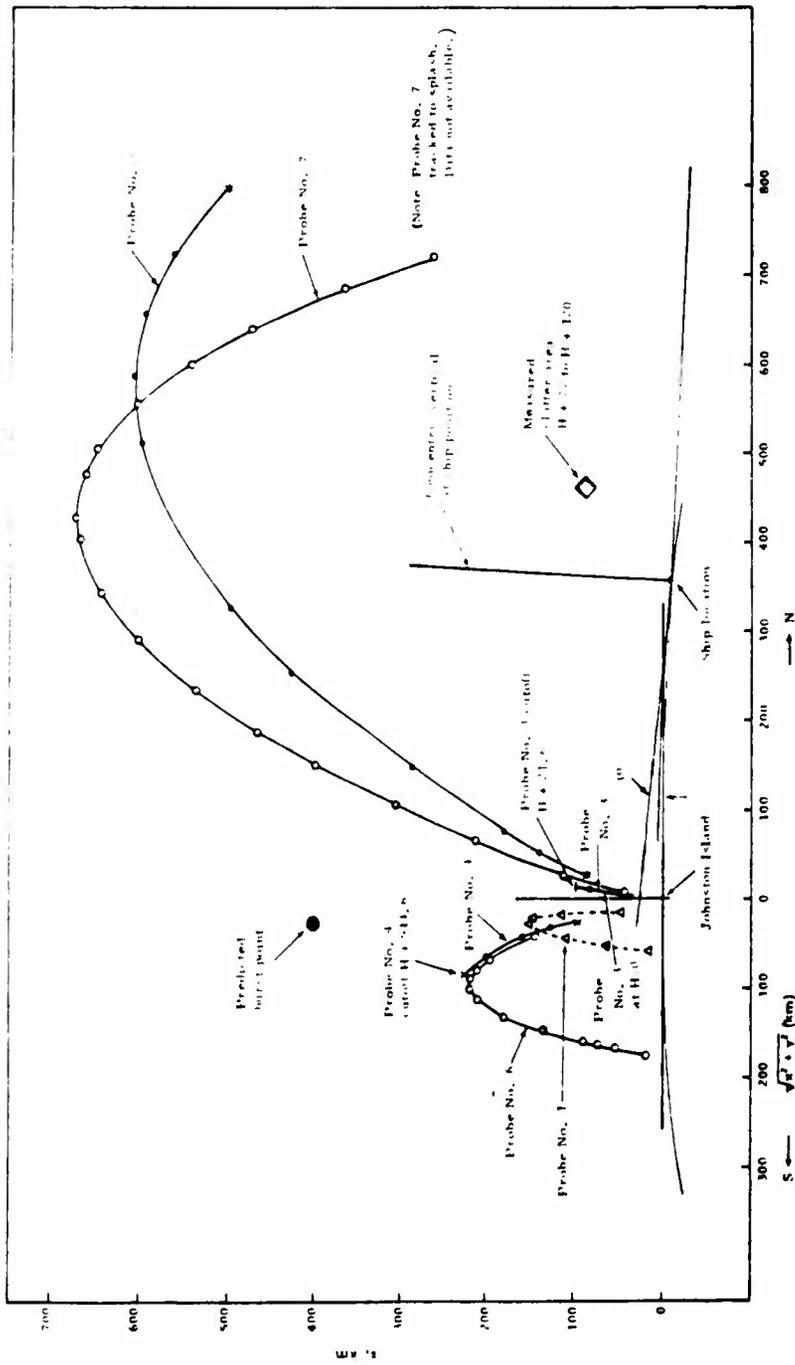


Figure 3.7 Star Fish Prime probe trajectories.

CHAPTER 4

C-BAND SIGNAL STRENGTH AND ERRORS (BEACON)

Appendix B contains the Sanborn records for all mission Radar 1 beacon tracking and acquisition intervals. The signal strength presented is the automatic gain control voltage of the tracking receivers of the FPQ-4. The records are annotated with events taken from the edited time and events records. Calibration of signal strength is presented in db/m units. This refers to the peak output power level of an RF pulsed signal generator. This signal generator output was fed to a waveguide run of several hundred feet, thence to the foremast horn from which the RF signal was radiated about 300 feet to the FPQ-4 antenna. When parameters were changed (bandwidth changes, local oscillators, etc.) during a mission, signal strength calibrations are included for each combination.

Angle error calibrations were obtained by moving the antenna from the foremast horn 10 mils in each of four directions.

Pre-mission and post-mission calibrations were available. However, for this report, the calibration occurring closer to the mission was included (Figure B.1).

The Sanborn records include a real-time GMT 13-bit digital 1-pulse/second code, repeated every 15 seconds. The pulses are of three different widths. The thickest pulse is the reference pulse. The left edge of this pulse signifies the beginning of a 15-second GMT interval. The next 13 bits designate which 15-second interval of the day begins at that reference pulse. Medium width pulses designate a "1," and thin pulses designate a "0." The two pulses following the reference pulse signify which 15-second interval of the minute, the following six signify which minute of the hour, and the following five signify the particular hour of the day. Thus, the pulse train 10, 100100, 10010 after the reference pulse means that the reference pulse left edge corresponds to 9 hours, 9 minutes, and 0 seconds GMT. The last pulse prior to the next reference pulse is a dummy pulse.

CHAPTER 5

UHF/L-BAND TRAJECTORY

Trajectory data for the UHF/L-band radar (Appendix C) has been reduced in the same manner as the trajectory data presented in the Port C-band tracking radar listings. The UHF-L listings, however, were derived from the Starboard C-band radar to which the UHF-L band radar was slaved during most of the mission.

Under conditions of UHF-L band slaving to the Starboard radar, the antenna will follow the C-band radar to within 6 milliradians in angle, provided the following angular rates are not exceeded:

Azimuth Velocity	25 degrees/sec
Elevation Velocity	14 degrees/sec
Azimuth Acceleration	110 degrees/sec
Elevation Acceleration	85 degrees/sec

It is believed that these rates were not exceeded during any mission.

Due to equipment limitations, the UHF-L band antenna cannot be slaved to the Starboard C-band radar during discontinuities in designation data (for example, when a point chosen for scanning is suddenly changed). These periods

during which the UHF-L antenna is slaved to the C-band radar are tabulated in the time and event record. For the remainder of the time, angles presented pertain only to the Starboard C-band radar.

It must be emphasized that the range (column 2) and all quantities transferred to Johnston Island refer to the range gate, although tracking was not employed. The position of the range gate on the intensity-modulated photographs is 21 Kyds after the pre-trigger; the position of the range gate on the amplitude versus range presentation is 21 Kyds after the pre-trigger, unless otherwise noted.

Although the mapping was generally continued for hours, only 900 seconds of look angles are presented, since the observed effects decreased rapidly (preliminary examination of the records reveals that, in general, nothing was seen after 5 minutes).

CHAPTER 6

TELEMETRY TRACKING POINTING ANGLES

There were no telemetry rockets utilized by DAMP during this event.

CHAPTER 7

VIDEO-DERIVED CROSS SECTION AND BEACON POWER (NEAR H-O)

Magnetic tape records were taken in each mission of ungated video from each of the radars. The video was supplied by special receivers intended solely for that purpose, and operating outside the radar tracking loops. The receivers had roughly logarithmic transfer characteristics, compressing 80-decibel input variations to the 32-decibel dynamic range of the video recorders. They contained no AGC loop. In data reduction, the amplitude of each received pulse was recovered from the video tapes, and by applying calibration information, it was converted to received peak power relative to an arbitrary reference. The video bandwidth used during playback was 0.6 megacycle.

For the beacon returns, power variation with changing distance between the radar and the beacon was removed by dividing the received power by the square of the slant range. The resulting normalized received beacon power (in decibels) was plotted versus time in the vicinity of H-O (Figure 7.1).

For Tight Rope, the echo return from the DAMP Nike-Hercules was discernible in the video records, and its C-band radar cross section was computed and plotted.

The calculation was

$$\sigma = \sigma_r \frac{SR^4}{S_r R_r^4}$$

where: σ \equiv radar cross section

S \equiv received power relative to a common (arbitrary)
reference

R \equiv slant range to the target

The quantities without subscripts refer to the Nike-Hercules. The quantities with subscript r refer to the post-mission track of a balloon-borne 6-inch-diameter aluminum sphere, whose cross section was calculated to be σ_r .

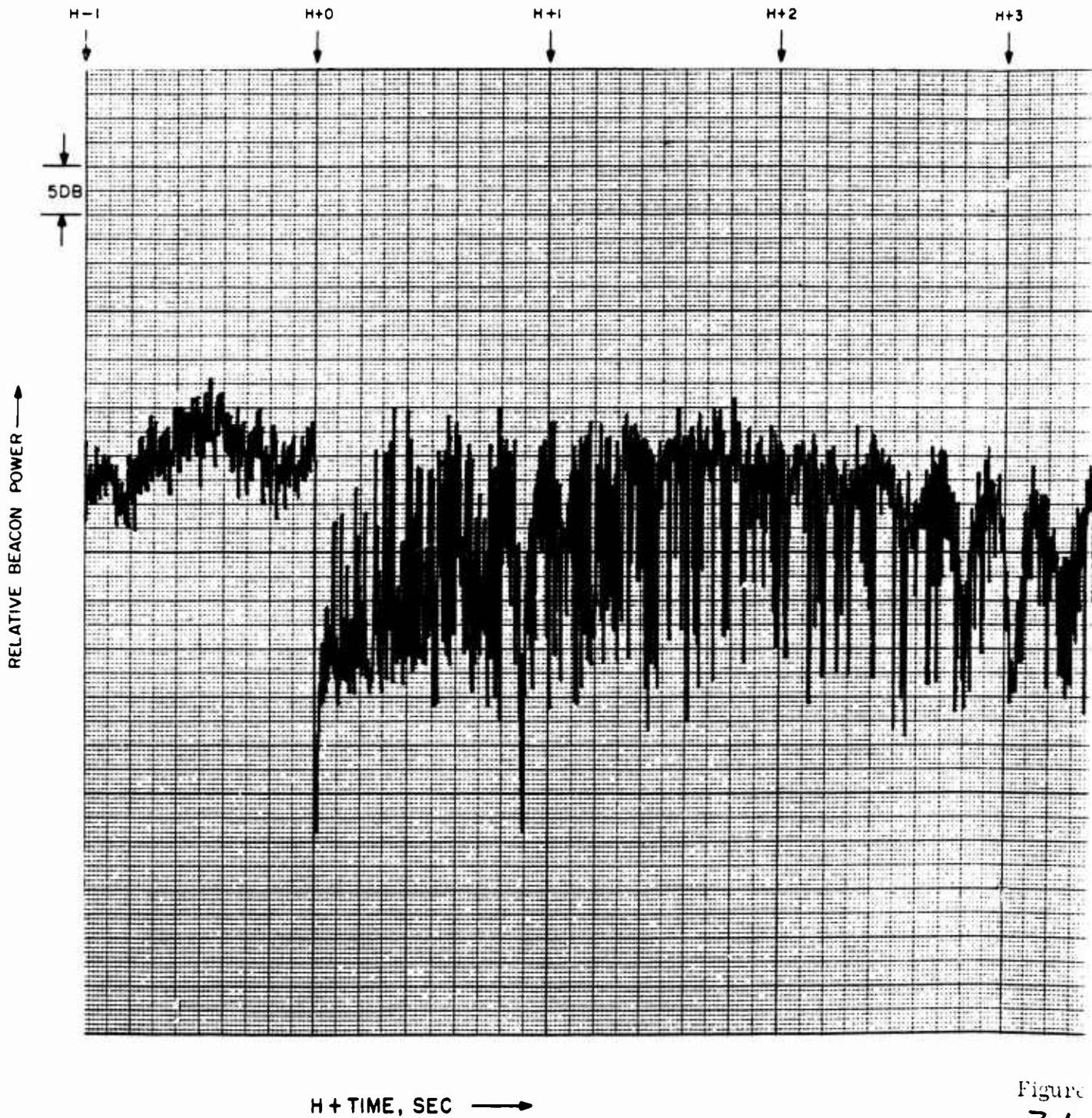


Figure
7.1

55-1

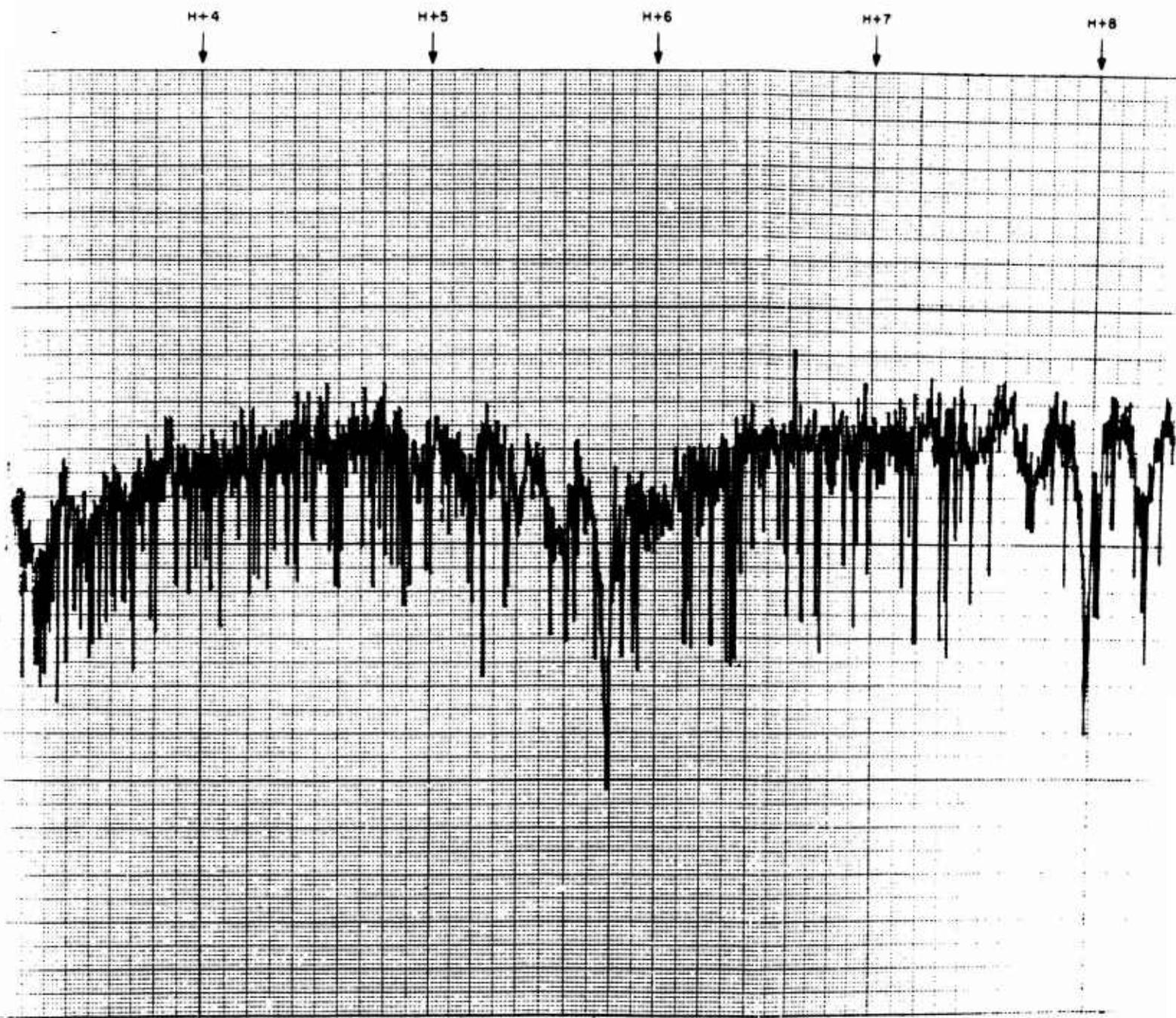


Figure 7.1 Star Fish Prime video-derived beacon power.

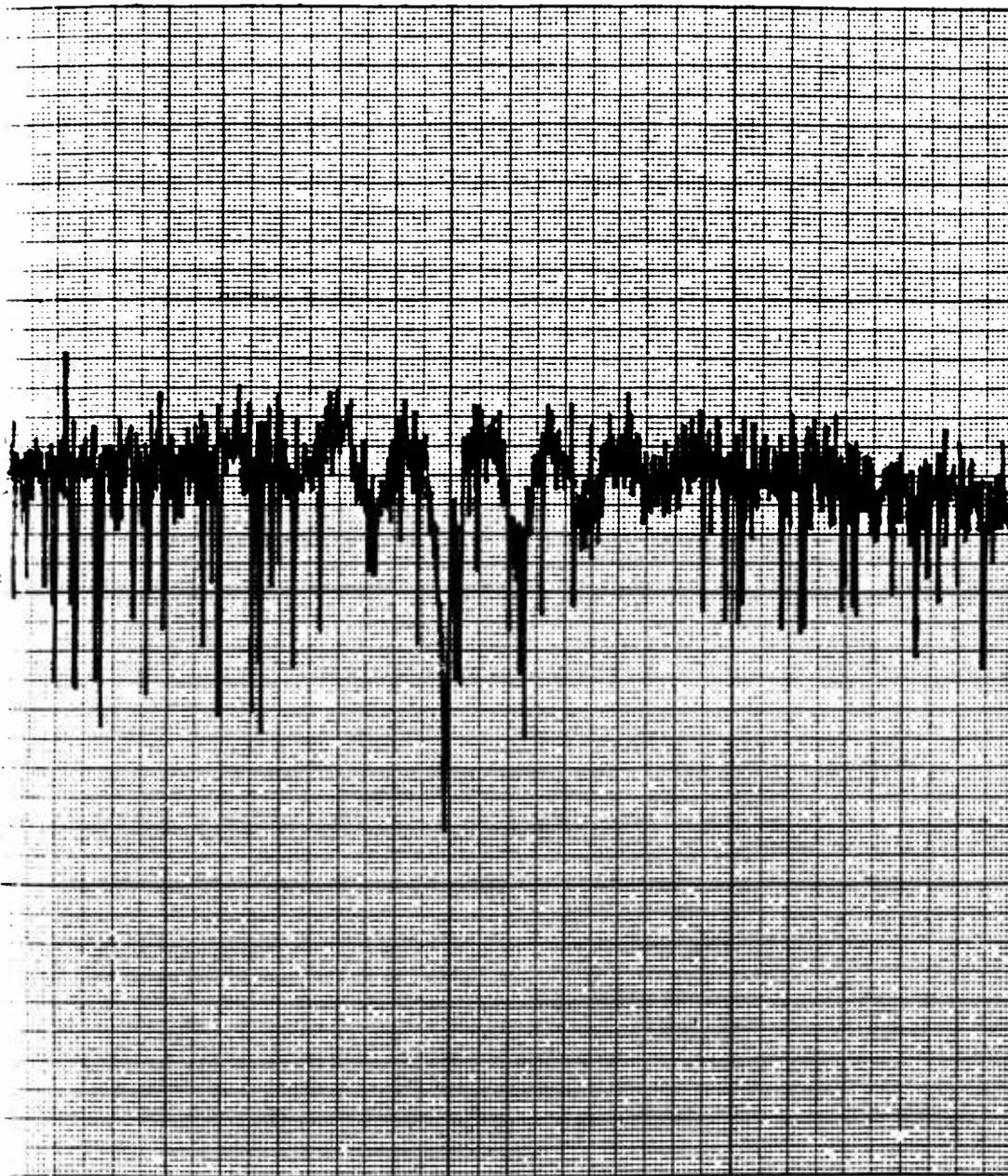


H+7

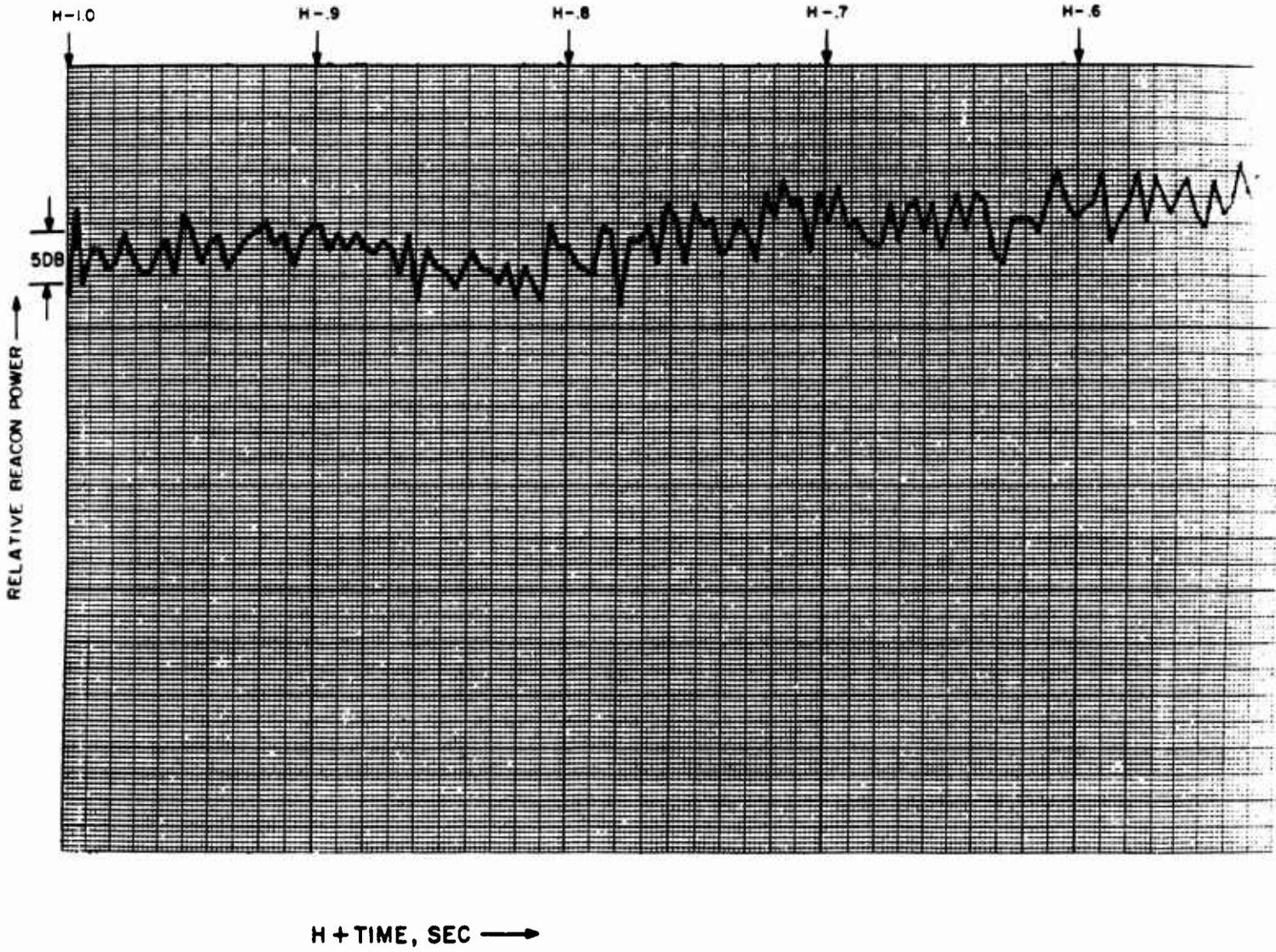
H+8

H+9

H+10



55-3



56-1

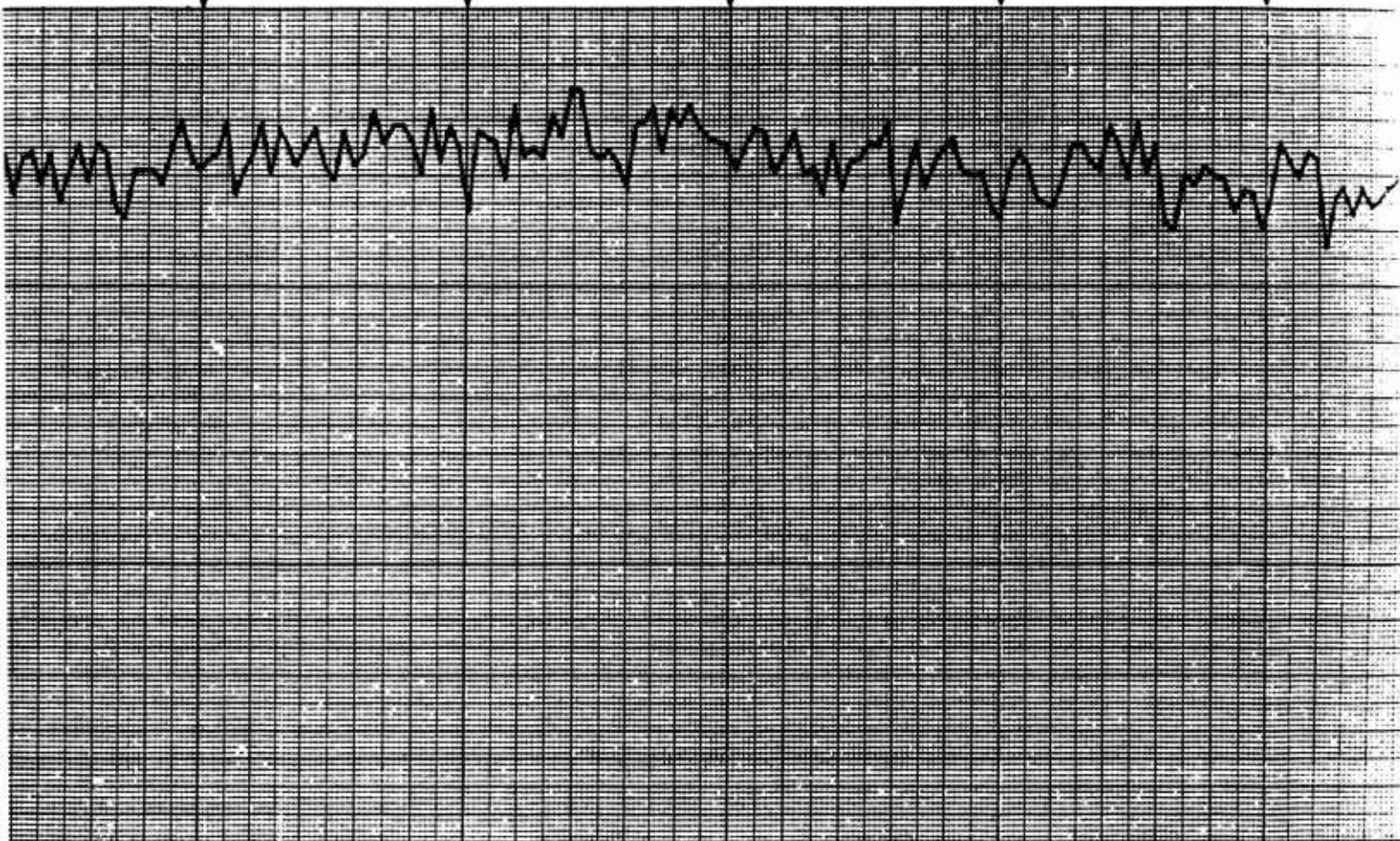
H-6

H-5

H-4

H-3

H-2



56-2

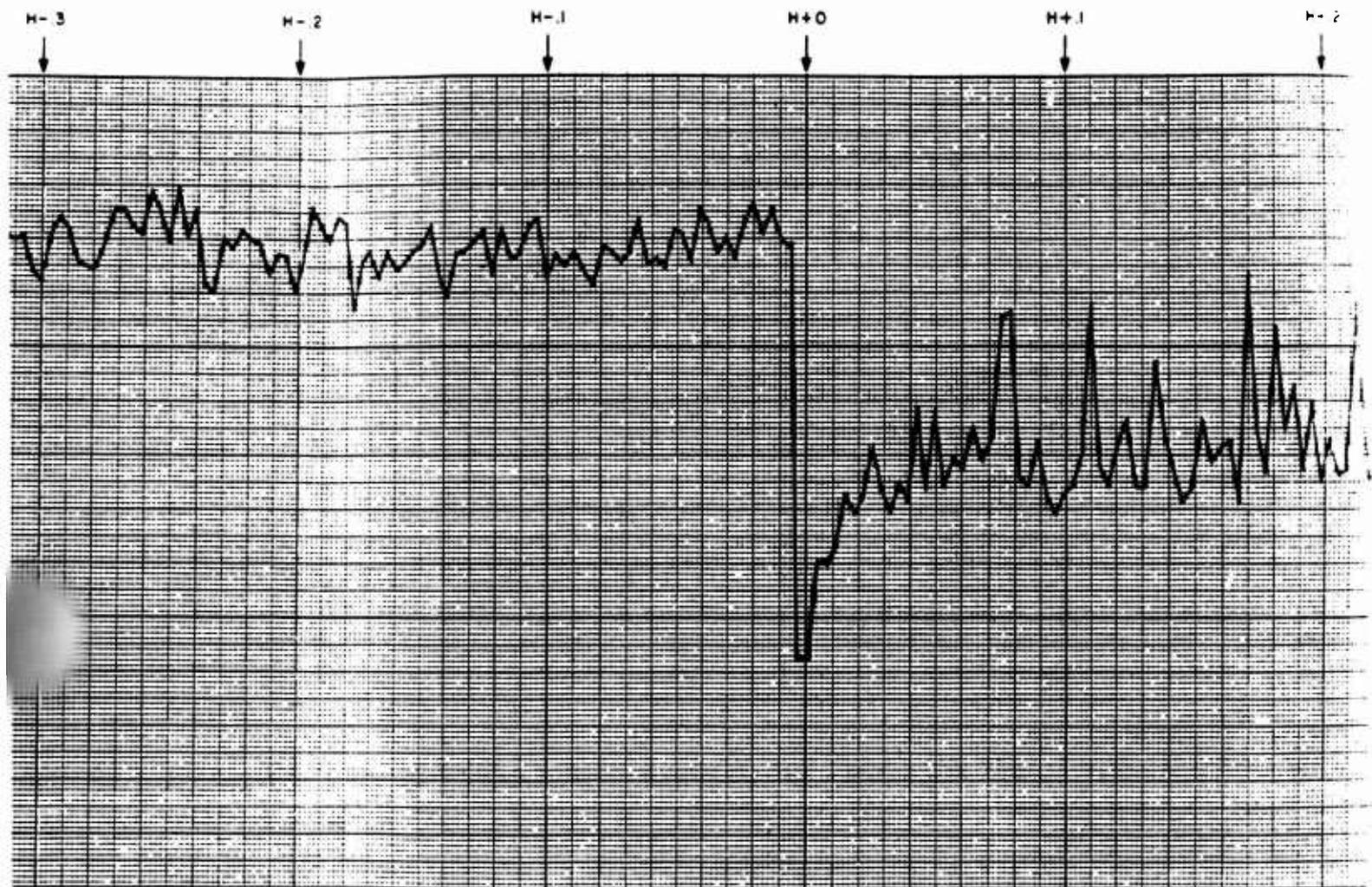


Figure 7.1 Continued.



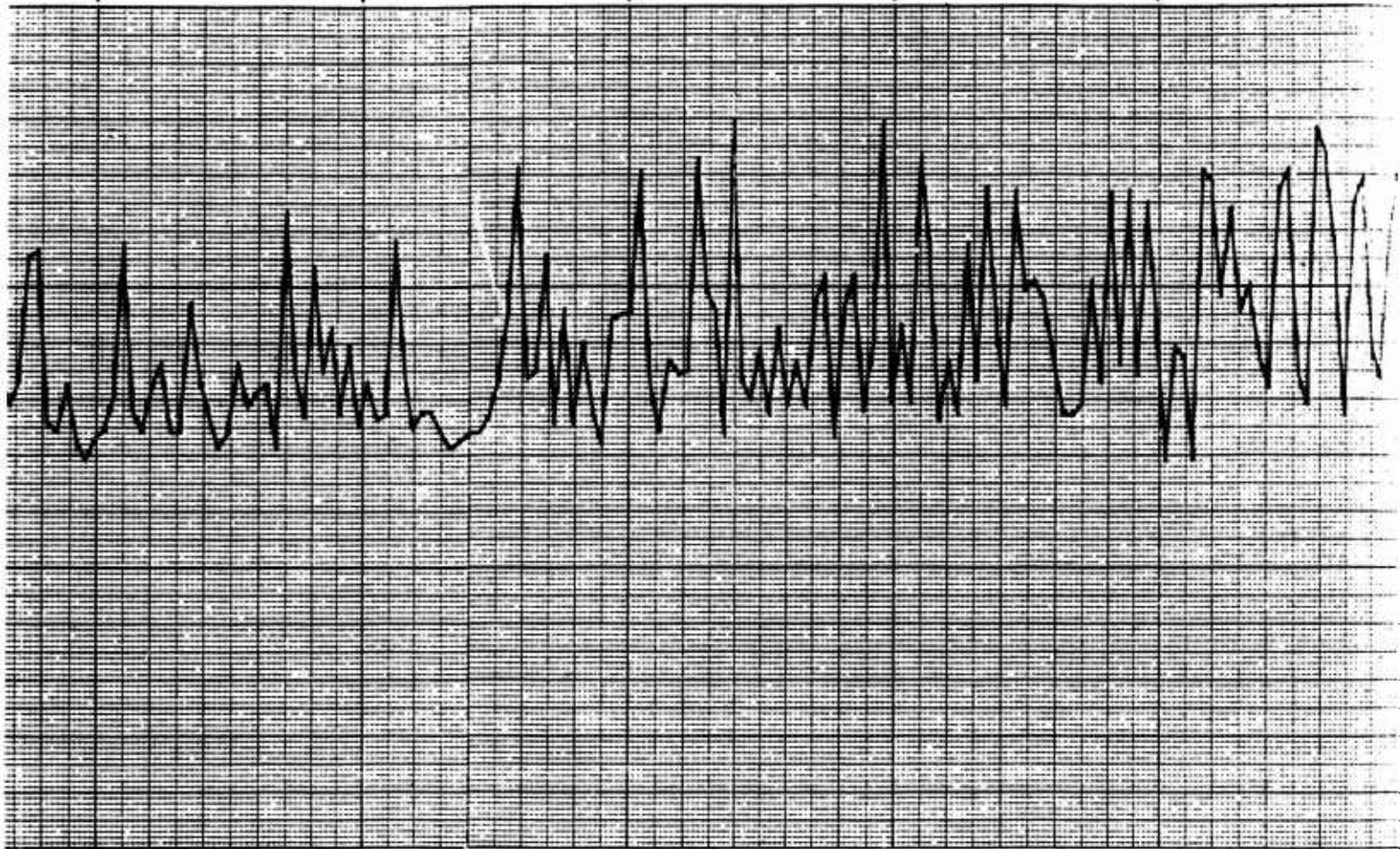
H+1

H+2

H+3

H+4

H+5



56.4

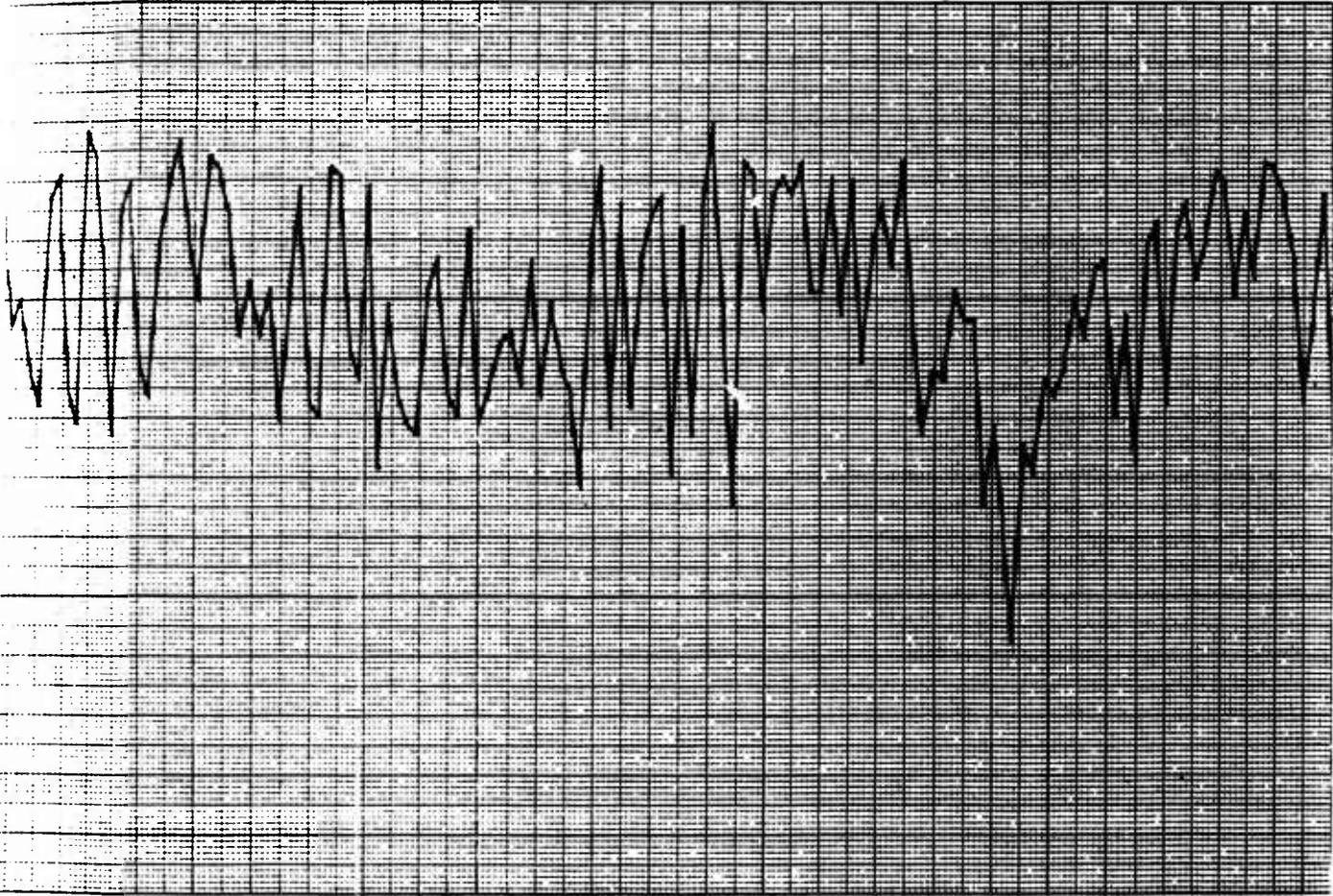
H+6

H+7

H+8

H+9

H+10



56-5

CHAPTER 8

TELEMETRY TRACKER SIGNAL STRENGTH AND ANGLE ERRORS

No rocket-borne telemetry transmitters were scheduled by DAMP during this event to monitor the nuclear effects at UHF or to monitor C-band beacon performance. The Thor booster telemetry health transmitter was tracked by the telemetry tracker, and sub-carrier modulations were recorded to provide backup data in the event of Thor malfunctions. However, since burnout of the Thor booster occurred approximately 15 minutes prior to burst, no telemetry data is presented for the Thor telemetry tracking interval.

CHAPTER 9

VIDICON MEASUREMENTS

All Speedball rockets launched during the Star Fish Prime event were equipped with a Daisy flare ejector system, so that optical measurement of the Speedball target could be used for comparison with the radar line of sight to provide a concurrent estimate of refractive anomalies at optical frequencies. However, due to the inclement weather during Star Fish Prime in the vicinity of the DAMP ship, no optical measurement attempts yielded data.

CHAPTER 10

FIREBALL AND DEBRIS RADAR REFLECTIONS; AURORAL-TYPE CLUTTER RETURNS; RADIOMETER AND RIOMETER BACKGROUND MEASUREMENTS

10.1 FIREBALL AND DEBRIS REFLECTIONS AND AURORAL-TYPE CLUTTER RETURNS

The shipboard digital computer was used to designate the Starboard tracking radar to various angles and ranges at which radar returns were expected, and to scan the radar about each of these points using scan dimensions which increased with elapsed time after burst. The 28-foot-parabola UHF/L-band radar was slaved to the Starboard C-band radar during these scanning periods, which have been referred to as clutter mapping. The general sequence employed was to first examine the burst area to provide a three-frequency measurement of the absorption and reflection properties of the expanding fireball, and then to observe the geomagnetically aligned auroral-backscatter areas expected to the north of the ship when viewing the ionosphere perpendicularly to the field lines.

A general summary of this data is given in Volume 1. A more detailed presentation of the data on a single radar pulse basis is given in Volume 7.

10.2 RADIOMETER MEASUREMENTS

A Dicke-type comparison radiometer was used in the expectation of deriving background radio noise temperatures. This radiometer was used in conjunction with the UHF/L-band 28-foot dish, but derived its RF signal from the horizontally polarized portion of the feed horn rather than the vertically polarized portion used by the UHF/L-band radar for normal receive and transmit.

Generally speaking, the data derived from the radiometer is inconclusive. Heavy interference was noticed on all tests, and on one test the fluctuations due to interference just prior to H-0 can be seen to encompass the entire dynamic range of the instrument.

10.3 RIOMETER DATA

At the request of Stanford Research Institute (SRI), riometers operating on frequency assignments of 30, 60, and 120 Mc were installed on the American Mariner to be included in the DAMP experiments. The equipment collected data during each of the five Fish Bowl events, and during some low-altitude, air-drop tests near Johnston Island. In this experiment, however, DAMP provided only the technician services required to maintain, monitor, and

service the sensing and recording equipment connected with the riometer system. All riometer data obtained by the DAMP ship was delivered to SRI, and inquiries concerning the data are referred to that organization. The presentation and analysis of this data and the correlation of the data with other riometer sensors may be found in Reference 2.

CHAPTER 11

TRANSIT AND PROJECT 6.1 COHERENT MEASUREMENTS

Doppler measurements of the very stable 150-megacycle and 400-megacycle Transit 4A satellite CW transmissions were performed for every usable satellite pass occurring within several weeks of the Fish Bowl events. The system used to record the data was the actual DAMP shipboard Transit navigation system, which normally gives ship's position from the difference between predicted and observed satellite doppler curves, using reiterative digital computations. Based on either the navigator's normal measurement of ship's position, or, utilizing the radar tracking data during a mission to obtain ship's position, a measurement of the absolute doppler shift could be inferred from the measured doppler curve. It was hoped that a Transit pass would occur at H - 0 during at least one event so that the early time pronounced effects could be measured. However, the closest pass available occurred at H + 1 hour, during Star Fish Prime.

The Transit measurements are presented in Volume 7.

No Project 6.1 rockets were tracked by the DAMP ship during this event, since all available 6.1 transmitting frequencies were outside the frequency range of the DAMP measurement system.

PART 2

OPTICAL MEASUREMENTS

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PART 2
OPTICAL MEASUREMENTS
CHAPTER 12
DATA PRESENTATION

The targets during these tests were extended and generally covered fully the fields of view of the photometers and radiometer. It is therefore convenient to express the data in terms of brightness (radiance) (watts $\text{cm}^{-2} \Omega^{-1}$) rather than irradiance. (All quoted values are absolute, not brightnesses above adjacent background.) The relationship between brightness and irradiance, for the instruments under discussion, when the fields of view are totally covered, is:

irradiance = brightness (radiance) x subtended solid angle

or

$$H = N \cdot \Omega$$

The solid angle of the source when the field of view is filled is simply the solid angle of the instrument. For the photometer (1° circular field of view) this is:

$$\begin{aligned} \Omega &= \pi \tan^2(\theta/2) \quad (\theta/2 = \text{half angle of field}) \\ &= 2.39 \times 10^{-6} \text{ steradian} \end{aligned}$$

Similarly, for the radiometer ($2^\circ \times 2^\circ$ square field of view) it is:

$$\begin{aligned}\Omega &= 4 \tan^2 (\theta/2) \\ &= 1.22 \times 10^{-3} \text{ steradian}\end{aligned}$$

It follows, then, that:

$$\begin{aligned}N &= H \cdot \Omega^{-1} \\ &= H \times 4.18 \times 10^3 \text{ (photometers)} \\ &= H \times 8.21 \times 10^2 \text{ (radiometer)}\end{aligned}$$

The fields of view are not totally filled at all times, and as a result some of the data presented are integrated (intensity and spatially) values. When the fields of view are fully covered, such as on the major portion of the fireball mappings, notations will be made.

Instrument malfunctions, insensitivity, pedestal pointing inaccuracies, weather, and over-exposures all contributed to a reduction of the amount of data gathered. In some cases, the instruments mechanically malfunctioned, and in others the exposure level was too low (or too high) to be recorded satisfactorily. Ballistic cameras in particular did not contribute to the data as a result of the low flare intensities. In the following pages, when an instrument is not discussed, it should be understood that either no significant data were recorded or a malfunction occurred.

CHAPTER 13

PROCEDURE

13.1 TEST PARTICIPATION

The DAMP ship, USAS American Mariner, participated in five tests during Fish Bowl. The important parameters of the tests are shown in Table 13.1. It is informative to note that they can conveniently be divided into high-altitude tests (Star Fish Prime, Check Mate, and King Fish) and low-altitude tests (Blue Gill Triple Prime and Tight Rope). Additionally, high- and low-yield devices were detonated at both altitudes, further contributing to data cross-correlation.

13.2 INSTRUMENTATION DESCRIPTION

As a result of experience obtained during each test, the instrumentation was under constant modification during the series. Table 13.2 lists all of the instruments utilized during the tests, and Figure 13.1 shows the instrumentation shipboard placement for the individual tests.

13.3 USE OF INSTRUMENTATION

Instrumentation was divided into three major groups according to their usage: (1) burst measurement equipment,

(2) long-term (mapping) measurement equipment, and (3) support equipment.

Excessively high radiation levels were anticipated during the initial seconds after detonation, and it was necessary to protect the sensitive electronic equipment (photometers and radiometer) from damage. As they were all positioned on Pedestal 1, the pedestal was directed away to nearly a right angle (in azimuth) from the predicted burst co-ordinates and was trained on the burst only when the levels had decayed sufficiently. The additional burst measurement equipment was under control of the TV-monitored optical director. As a consequence of the protection precautions, it was not possible to view early burst events with the photometers or radiometers. Individual instruments in each of the major divisions are listed below.

13.3.1 Burst Measurement Equipment. This equipment consisted of the following instruments: (1) total-thermal-power-time radiometer; (2) 70mm high-resolution camera; (3) 16mm DBM-5 cameras; (4) 70mm streak objective spectrograph; and (5) 35mm Flight Research camera (XR emulsion).

13.3.2 Long-Term Measurement Equipment. The equipment, operated during mapping periods, consisted of the following instrumentation: (1) thermograph and

complementary K-24 Star camera (used only on Check Mate and Blue Gill Triple Prime); (2) two 35mm Flight Research boresight cameras; (3) four-channel photometer; (4) R4K1 PbS radiometer; (5) R4K1 thermistor radiometer; (6) all-sky camera operated for Stanford Research Institute (SRI).

13.3.3 Support Equipment. The following equipment supported the gathering of optical flare data from the 6.13 Speedball probes: (1) eight K-19 ballistic cameras located on Johnston Island, and (2) K-24 ballistic (probe) camera operated aboard the DAMP ship.

Another instrument that was utilized as support equipment throughout the entire experiment was the modified Kintel acquisition television system. This system, in conjunction with Optical Director No. 2, was designed to provide pointing information to the slave pedestal carrying instruments committed to the burst phase of the experiments.

13.4 CALIBRATION

Premission background measurements were recorded by H - 60 minutes. All quantitative measurement instruments were calibrated using as a source of radiation either a standard blackbody (up to 1000° K) or National Bureau of Standards (NBS) calibrated tungsten ribbon lamp. The full dynamic range of the instrument outputs (film density or voltage) were covered in the calibration. Also, preburst background mappings were completed to aid in data analysis.

TABLE 13.1 TEST PARAMETERS

Test	DATE	Yield	Altitude	H - 0	Slant Range	Elevation	Remarks
	1962	kt	km	GMT	km		
Star Fish Prime	ZULU 9 Jul	1.4 (Mt)	400	09:00:09	560 (Pred.)	44.4° (Pred.)	Obscured by clouds
Check Mate	20 Oct	[REDACTED]	147.3	08:30:00	315	27.8°	Partially obscured by clouds
Blue Gill Triple Prime	26 Oct	[REDACTED]	48.3	09:59:48	144	19.6°	Detonated behind cloud but rose above. Excellent coverage.
King Fish	1 Nov	[REDACTED]	97.4	12:10:06	190	30.8°	Excellent coverage. Clouds formed at H + 15 minutes
Tight Rope	4 Nov	[REDACTED]	21.0	07:30:00	28	48.6°	Low altitude, close range

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TABLE 13.2 FISH BOWL INSTRUMENTATION

Instrument	Field of View	Spectral Sensitivity	Emission/Detector	Chop or Frame Rate	Exposure Time	Remarks
<u>35mm Camera</u>						
No. 1	7° x 9°	.38 - .65μ	Super Hypan	12/sec	1/36 sec	Optical Director Boresight
No. 2	7° x 9°	.38 - .65μ	Super Hypan	12/sec	1/36 sec	Pedestal 1 Boresight
No. 3	13.7° x 18.2°	.38 - .65μ	XR (Wyckoff)	32/sec	1/320 sec	Pedestal 2 Boresight. Triple Layer Emission
<u>70mm Camera</u>						
High Resolution	3.2° x 3.2°	.38 - .65μ	Tri-X Pan	32/sec	1/720 sec	
Streak Spectrograph	11° x 12°	.38 - .70μ	Plus-X Aerecon	144 in./sec	N/A	
Long Focus	5.4° x 12°	.38 - .65μ	Tri-X Pan	30/sec	1/1020 sec	Used only on Tight Rope
Long Focus (Spectral)	5.4° x 12°	.38 - .9μ	Infrared	15/sec	1/1020 sec	Used only on King Fish
<u>16mm Camera</u>						
	10.7° x 8.3°	.38 - .65μ	Tri-X Pan	400/sec	1/4000 sec	High Speed Record of Tests

TABLE 13.2 (CONTINUED)

Instrument	Field of View	Spectral Sensitivity	Emission/ Detector	Chop or Frame Rate	Exposure Time	Remarks
<u>Ballistic Camera</u>						
K-24 (Star)	40° x 40°	.38 - .70μ	Tri-X Aercon	Sequenced	10, 30 sec	To obtain star background for thermograph
K-24 (Probe)	40° x 40°	.48 - .53μ	Tri-X Aercon	Sequenced	45 sec	To obtain speedball flare positions
K-24 (Spectral)	40° x 40°	.38 - .70μ	Tri-X Aercon	Sequenced		Used on Blue Gill Triple Prime and King Fish
K-19 (Probe) (4)	37° x 45°	.48 - .53μ	103-F	Plate	Variable	Positioned on Johnston Island. Probe-flare data
<u>All-Sky Camera</u>	160°	.38 - .65μ	Royal-X Pan	53 sec	53 sec	Stanford Research Institute received data
<u>Photometer</u>						
1	1° circular	4036 Å	6810 PMT	1/50 sec resolution	N/A	Photometers used on all tests. Filters chosen to record selected nitrogen aurora
2	1° circular	7000 Å	7102 PMT	1/50 sec resolution	N/A	Normal half bandwidths of 100 Å
3	1° circular	8846 Å	6217 PMT	1/50 sec resolution		
4	1° circular	3892 Å	6903 PMT	1/50 sec resolution		

TABLE 13.2 (CONTINUED)

Instrument	Field of View	Spectral Sensitivity	Emulsion/ Detector	Chop or Frame Rate	Exposure Time	Remarks
<u>Radiometer</u> 1	2° x 2°	1.8 - 2.8 μ	Lead Sulphide	1/50 sec resolution	N/A	Total chop mode
2	2° x 2°	1.8 - 15 μ	Thermistor	1/50 sec resolution	N/A	Did not record data
Total Thermal Radiometer	~35°	.3 - 15 μ	Thermistor	1000 cycle/ sec	N/A	Two channel 5, no optics
Thermo- graph	5° x 20°	1.8 - 15 μ	Thermistor	50 sec/ picture	N/A	Printed on photo- record of backgrounds

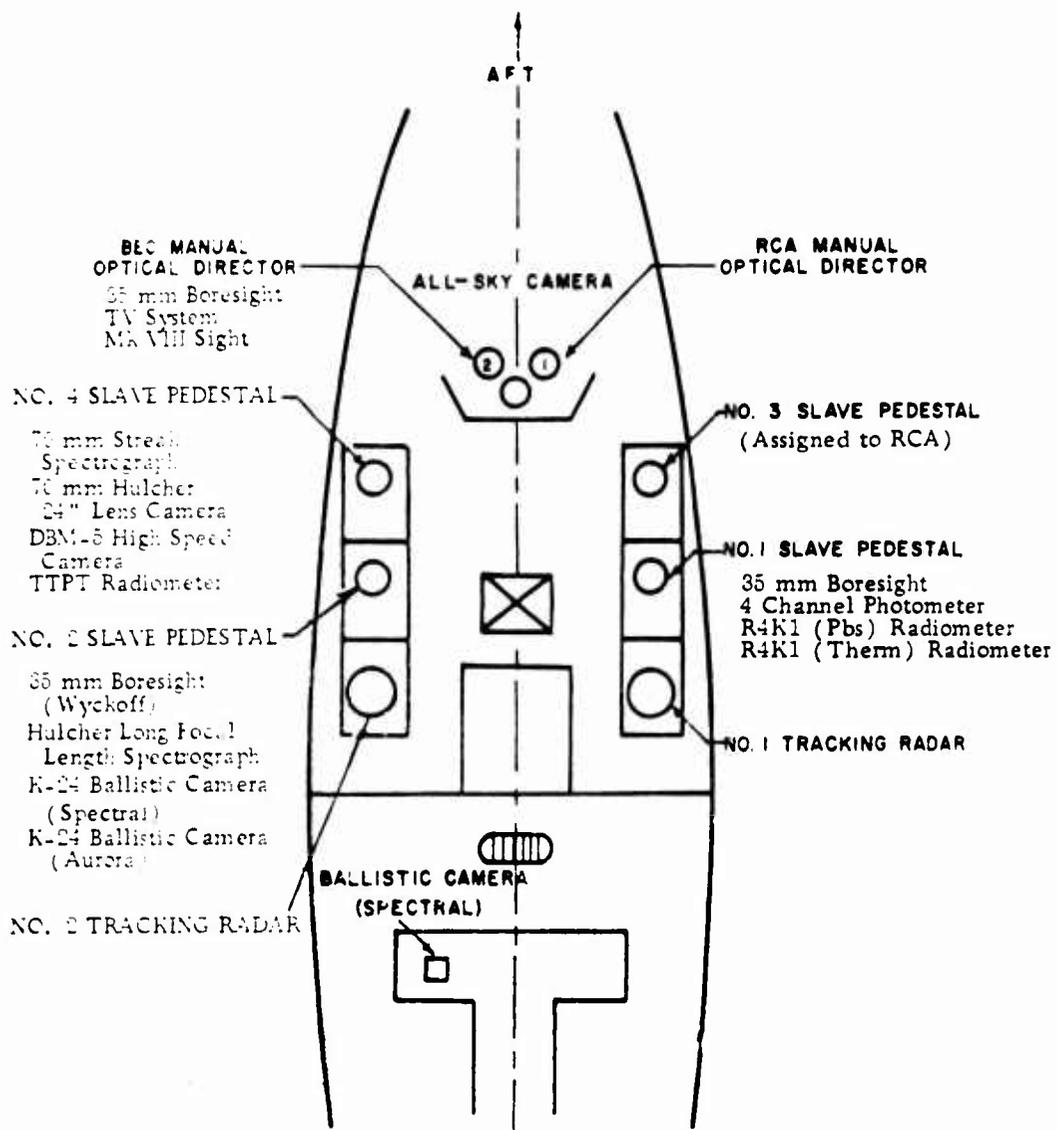


Figure 13.1 Instrumentation layout, DAMP ship.

CHAPTER 14

RESULTS

14.1 BURST MEASUREMENTS

Inclement weather prevented the gathering of satisfactory data in support of pretest objectives. Photographic instrumentation recorded an opalescent background produced by a dense layer of clouds uniformly illuminated by the burst. Burst instrumentation was directed to the point of detonation by Optical Director No. 2. The following descriptions are those of data obtained by each burst instrument.

The 70mm high-resolution camera started 10 seconds prior to burst and operated for 60 seconds. Data were recorded from $H - 0$ to $H + 0.3$ second and consisted of 10 frames of evenly exposed, unimaged intensities. At $H - 0$ the frame containing the burst was totally opaque, and each successive frame became less dense with time.

The 16mm DBM-5 high-speed camera was started 10 seconds prior to detonation and operated for 37 seconds. Data were recorded from $H - 0$ to $H + 0.01$ second, and consisted of 4 frames of evenly exposed, unimaged intensities. At $H - 0$ the frame containing the burst was totally opaque, and each of the three successive frames became less dense with time.

The 70mm streak objective spectrograph was started 10 seconds prior to detonation and operated for 39 seconds. Burst data were recorded from H - 0 to H + 4 seconds and consisted of a 48-foot length of dense exposed film. The remaining length of film decreased in density with time.

The TIPT Radiometer—Channel A and Channel B—was started 120 seconds prior to H - 0. This instrument was operated until H + 379 seconds, during which time Channel A recorded a pulse width of 0.5 msec with an amplitude of 4 volts, and Channel B recorded a pulse width of 0.2 msec with an amplitude of 0.5 volt. Both pulses were recorded at H - 0, and their amplitudes decay with time. Although highly attenuated by dense clouds, results from this instrument are tentatively positive.

The 35mm flight research Wycoff camera was started 10 seconds prior to detonation and operated for 200 seconds. The results were expected to be similar to the 70mm high-resolution camera.

14.2 LONG-TERM MEASUREMENTS

A long-term period of surveillance was conducted in support of the pretest objectives. However, inclement weather resulted in a serious degradation of recorded information. This surveillance consisted of mapping an area surrounding the burst point, the

conjugate point, and large azimuth and elevation scan patterns covering the operational limits of the optical director and the instrumented slave pedestals.

Post-mission mapping was started at H + 323 seconds and continued intermittently until sunrise on D + 1 day. The sampling periods were taken every half-hour with a duration of from 5 to 10 minutes. A 5-minute final mapping mission was conducted after sunset on D + 1 day.

During the mapping periods, almost total cloud coverage persisted. No auroral phenomena were observed at any time. In addition, no long-term effects were believed to have been recorded which could be directly attributed to the nuclear detonation. It is significant to note that little, if any, long-term effects were recorded in the monitored wavelength regions. In this respect, the severe attenuations imposed on the selected wavelength regions by intermittent precipitation and heavy cloud coverage must be considered. Individual instruments with their preliminary results are listed below:

R4K-1 Thermistor Radiometer. The results from this instrument are unknown due to low levels of recorded signal, but results are believed to be negative.

R4K-1 Lead Sulfide (PbS) Radiometer. The results from this instrument are unknown due to low levels of recorded

signal, but the results are believed to be negative.

4-Channel Photometer. The results from this instrument are unknown due to low levels of recorded signal, but results are believed to be negative.

35mm Boresight Camera (Slave Pedestal 1). Due to heavy rains, this camera was started after burst at H + 447 seconds and stopped at H + 1245 seconds. No positive results were obtained.

After burst, the thermograph and star camera were directed at the detonation point by the operator. Four thermograph exposures and a sequence series of 3-star exposures for each thermograph exposure were made. The results were negative.

35mm Boresight Camera (Optical Director 2). This camera was not operated due to the lack of recordable optical phenomena.

The all-sky camera was operated for Stanford Research Institute and the film delivered to that organization for review. Recording commenced prior to Thor lift-off and ceased at sunrise on D + 1 day.

14.3 SUPPORT INSTRUMENTATION

Eight K-19 aerial ballistic cameras were mounted on Johnston Island to record optical flare data from the Speedball probes. These probes

ejected 14 flares at designated points along the trajectory. Positive results were obtained from four of the eight K-19 cameras.

Because of total cloud coverage, the K-24 ballistic (probe) camera mounted on the DAMP Ship yield negative results with respect to flare data.

APPENDIX A

PROBE SUMMARY

The trajectory listings are time referenced to the beginning of the GMT second in which burst occurred. Therefore, H + 0 in the listings corresponds to H - 0.029 second for Star Fish Prime, to an accuracy of 50 milliseconds.

Approximate Tracking Records				
Project	Lift-Off	Begin	End	Azimuth
	sec	sec	sec	deg
9.1a	H-1809	H-1754	H-1451	177
6.7	-100			NOT TRACKED
6.13	-50	H-13	H+22	349
6.13	+710	H+782	+945	205
6.2	+1200	+1292	+1810	30
6.13	+1860	1900 ^a	2140	167
		2182	2303	26
6.2	+2400	2441	3223	

^aDigital recorder tapes were being changed in the interval H+1900 to H+1951, and no recorded trajectory is available for this interval.

Probe No. 1; 11ft-off time: H-1809 seconds; and project No. 9.1a

Raw data referenced to the ship		Quantities have been translated to the launcher position									
Time, sec	Range, km	Azimuth, deg T	Elevation, deg Geod.	x, km distance east	y, km distance north	z at launcher	$\sqrt{x^2 + y^2}$, km	Height above earth, kft	Height above earth, km	Latitude of target, deg	Longitude of target, deg

-1754.00	369.09	190.31	9.03	0.32	-6.37	63.48	224.78	68.49	16.6970	-169.1254
-1753.00	370.19	190.37	9.11	0.18	-6.02	69.17	276.78	69.17	16.6949	-169.1258
-1752.00	370.79	190.35	9.14	0.07	-6.63	70.66	231.82	70.66	16.6946	-169.1261
-1751.00	371.18	190.10	9.53	0.27	-6.81	71.93	216.01	71.93	16.6932	-169.1270
-1750.00	371.59	190.15	9.75	-0.04	-6.83	73.60	240.83	73.60	16.6931	-169.1273
-1749.00	371.78	190.31	9.66	0.14	-6.89	74.21	243.48	74.21	16.6907	-169.1278
-1748.00	372.19	190.31	10.09	0.16	-6.94	75.15	246.54	75.15	16.6891	-169.1282
-1747.00	372.80	190.27	10.17	0.33	-6.96	76.31	250.37	76.31	16.6875	-169.1286
-1746.00	373.21	190.27	10.14	0.33	-6.93	77.51	254.29	77.51	16.6864	-169.1291
-1745.00	373.67	190.30	10.47	0.14	-6.75	78.43	257.32	78.43	16.6869	-169.1292
-1744.00	374.03	190.29	10.71	0.18	-6.78	80.04	262.62	80.04	16.6848	-169.1299
-1743.00	374.45	190.28	10.86	0.22	-6.71	81.17	266.16	81.17	16.6832	-169.1304
-1742.00	374.84	190.30	10.97	0.03	-6.13	81.89	268.68	81.89	16.6816	-169.1307
-1741.00	375.25	190.29	11.27	0.11	-6.13	83.57	274.18	83.57	16.6817	-169.1305
-1740.00	375.66	190.25	11.26	0.34	-6.53	83.92	275.35	83.92	16.6786	-169.1323
-1739.00	376.09	190.22	11.51	0.33	-6.54	85.61	280.89	85.61	16.6781	-169.1326
-1738.00	376.48	190.24	11.64	0.38	-6.61	86.61	283.88	86.61	16.6770	-169.1320
-1737.00	376.89	190.23	11.84	0.34	-6.72	87.94	288.54	87.94	16.6765	-169.1315
-1736.00	377.30	190.23	11.94	0.40	-6.73	89.65	290.86	89.65	16.6745	-169.1318
-1735.00	377.72	190.23	12.03	0.33	-6.87	89.65	294.48	89.65	16.6735	-169.1324
-1734.00	378.17	190.22	12.13	0.23	-6.29	90.75	297.75	90.75	16.6727	-169.1320
-1733.00	378.55	190.24	12.41	0.23	-6.29	92.00	303.50	92.00	16.6716	-169.1322
-1732.00	378.95	190.23	12.47	0.25	-6.56	93.79	307.51	93.79	16.6692	-169.1324
-1731.00	379.37	190.27	12.66	0.33	-6.25	94.38	309.67	94.38	16.6685	-169.1324
-1730.00	380.20	190.21	12.73	0.34	-6.90	95.71	314.01	95.71	16.6655	-169.1324
-1729.00	380.60	190.17	12.92	0.63	-6.93	96.72	317.35	96.72	16.6662	-169.1324
-1728.00	381.02	190.17	13.06	0.54	-6.11	97.67	320.47	97.67	16.6664	-169.1320
-1727.00	381.47	190.15	13.20	0.54	-6.27	99.57	323.47	99.57	16.6616	-169.1305
-1726.00	381.83	190.12	13.32	0.65	-6.44	97.67	325.90	97.67	16.6595	-169.1318
-1725.00	381.83	190.12	13.42	0.81	-6.67	102.22	328.83	102.22	16.6585	-169.1318
-1724.00	382.23	190.14	13.54	0.62	-6.78	101.47	332.94	101.47	16.6580	-169.1319
-1723.00	382.65	190.14	13.72	0.63	-6.94	102.42	336.03	102.42	16.6570	-169.1320
-1722.00	383.05	190.14	13.85	0.60	-6.95	103.25	338.76	103.25	16.6558	-169.1318
-1721.00	383.46	190.17	13.76	0.41	-6.10	104.06	341.44	104.06	16.6541	-169.1302
-1720.00	383.86	190.14	14.07	0.57	-6.27	104.88	344.09	104.88	16.6526	-169.1305
-1719.00	384.27	190.14	14.17	0.54	-6.47	104.88	348.19	104.88	16.6519	-169.1301
-1718.00	384.69	190.10	14.35	0.80	-6.55	106.12	348.19	106.12	16.6506	-169.1308
-1717.00	385.08	190.10	14.65	0.73	-6.70	106.89	354.75	106.89	16.6501	-169.1302
-1716.00	385.47	190.11	14.65	0.73	-6.76	107.97	358.25	107.97	16.6482	-169.1302
-1715.00	385.88	190.10	14.60	0.68	-6.78	107.97	360.52	107.97	16.6482	-169.1302
-1714.00	386.27	190.10	14.88	0.68	-6.78	109.48	360.52	109.48	16.6482	-169.1302
-1713.00	386.67	190.10	14.96	0.84	-6.84	110.21	361.57	110.21	16.6455	-169.1318
-1712.00	387.07	190.10	14.89	0.64	-6.78	110.21	364.20	110.21	16.6438	-169.1318
-1711.00	387.46	190.06	15.00	0.87	-6.47	112.09	367.79	112.09	16.6431	-169.1317
-1710.00	387.85	190.03	15.15	1.07	-6.56	112.09	370.02	112.09	16.6418	-169.1301
-1709.00	388.25	190.06	15.30	0.82	-6.70	112.77	371.75	112.77	16.6399	-169.1318
-1708.00	388.66	190.08	15.30	0.70	-6.92	113.30	375.05	113.30	16.6401	-169.1306
-1707.00	389.03	190.10	15.47	0.53	-6.10	114.55	375.05	114.55	16.6383	-169.1306
-1706.00	389.03	190.08	15.54	0.64	-6.10	115.14	380.22	115.14	16.6383	-169.1306
-1705.00	389.47	190.07	15.64	0.65	-6.10	115.82	382.50	115.82	16.6353	-169.1304
-1704.00	389.80	190.05	15.73	0.77	-6.45	116.56	385.50	116.56	16.6349	-169.1302
-1703.00	390.18	190.06	15.86	0.69	-6.45	117.56	385.50	117.56	16.6349	-169.1302

-1701.00	390.56	190.01	15.16	-11.71	119.17	11.71	197.73	118.10	16.6331	-163.5178
-1702.00	390.36	190.05	15.25	-11.71	119.01	11.86	190.48	119.25	16.6341	-163.5187
-1703.00	391.32	190.02	15.10	-12.07	119.45	12.10	191.95	119.47	16.6299	-163.5176
-1704.00	391.70	190.07	15.21	-12.07	119.30	12.20	192.31	119.31	16.6290	-163.5171
-1699.00	392.06	190.53	15.31	-12.33	121.11	12.40	198.64	120.49	16.6274	-163.5167
-1697.00	392.44	190.31	15.21	-12.33	121.17	12.53	198.88	121.58	16.6262	-163.5177
-1696.00	392.80	190.31	15.25	-12.41	121.00	12.63	199.31	122.32	16.6252	-163.5169
-1695.00	393.17	190.31	15.26	-12.41	121.13	12.73	199.88	123.10	16.6283	-163.5189
-1694.00	393.54	189.91	15.36	-12.43	121.08	12.96	200.29	123.76	16.6227	-163.5159
-1693.00	394.25	190.01	15.45	-12.73	124.58	13.08	200.79	126.60	16.6223	-163.5185
-1692.00	394.62	190.01	15.46	-12.73	124.67	13.25	201.00	127.51	16.6218	-163.5185
-1691.00	394.98	192.03	15.73	-13.37	126.76	13.43	201.91	128.88	16.6198	-163.5187
-1690.00	395.33	192.03	15.73	-13.37	126.83	13.66	202.67	129.85	16.6163	-163.5182
-1689.00	395.67	189.17	15.13	-13.1	124.81	13.84	203.06	127.43	16.6147	-163.5169
-1688.00	396.03	189.97	15.21	-13.35	125.08	13.97	203.10	128.10	16.6131	-163.5171
-1687.00	396.37	189.97	15.21	-13.35	125.06	14.01	203.48	129.04	16.6150	-163.5185
-1686.00	396.71	189.97	15.21	-13.35	125.12	14.07	203.65	129.74	16.6127	-163.5176
-1685.00	397.10	190.00	15.21	-13.35	125.19	14.17	203.82	130.41	16.6118	-163.5198
-1684.00	397.45	189.96	15.21	-13.35	125.23	14.27	204.00	131.00	16.6092	-163.5177
-1683.00	397.75	189.96	15.26	-13.35	125.33	14.37	204.32	131.55	16.6073	-163.5175
-1682.00	398.39	189.31	15.27	-13.35	125.39	14.49	204.80	132.42	16.6060	-163.5166
-1681.00	398.72	189.31	15.27	-13.35	125.35	14.59	204.88	132.37	16.6057	-163.5163
-1679.00	399.04	189.32	15.26	-13.35	125.64	14.89	205.89	132.86	16.6082	-163.5152
-1678.00	399.35	189.52	15.36	-13.31	125.56	15.17	206.19	133.56	16.6037	-163.5161
-1677.00	399.68	189.98	15.36	-13.31	125.31	15.33	206.30	133.49	16.6018	-163.5167
-1676.00	400.00	189.98	15.36	-13.31	125.37	15.44	206.30	134.59	16.6007	-163.5178
-1675.00	400.31	189.98	15.37	-13.31	125.65	15.70	206.84	134.67	16.5985	-163.5162
-1674.00	400.61	189.98	15.37	-13.31	125.32	15.74	206.92	135.34	16.5982	-163.5181
-1673.00	400.93	189.31	15.11	-13.39	125.75	15.93	206.53	135.27	16.5966	-163.5165
-1672.00	401.21	189.86	15.21	-13.35	125.17	16.10	206.67	136.14	16.5950	-163.5172
-1671.00	401.55	189.27	15.20	-13.35	125.25	16.30	206.59	136.59	16.5935	-163.5185
-1670.00	401.84	189.27	15.33	-13.31	125.06	16.45	206.74	137.08	16.5921	-163.5189
-1669.00	402.12	189.98	15.33	-13.31	125.29	16.50	206.89	137.74	16.5916	-163.5181
-1668.00	402.41	189.71	15.45	-13.31	125.64	16.55	207.19	138.31	16.5917	-163.5161
-1667.00	402.69	189.88	15.45	-13.31	125.63	16.68	207.39	138.66	16.5899	-163.5176
-1666.00	402.97	189.86	15.45	-13.31	125.63	16.98	207.99	138.71	16.5873	-163.5177
-1665.00	403.27	189.86	15.45	-13.31	125.10	17.10	208.10	139.32	16.5865	-163.5183
-1664.00	403.56	189.94	15.45	-13.31	125.10	17.35	208.40	139.42	16.5842	-163.5156
-1663.00	403.83	189.94	15.45	-13.31	125.27	17.32	208.30	140.10	16.5845	-163.5182
-1662.00	404.13	189.86	15.45	-13.31	125.67	17.50	208.25	140.59	16.5815	-163.5187
-1661.00	404.35	189.86	15.45	-13.31	125.63	17.65	208.33	140.92	16.5796	-163.5181
-1660.00	404.67	189.86	15.45	-13.31	125.63	17.99	208.22	140.92	16.5783	-163.5183
-1659.00	404.88	189.85	15.23	-13.31	125.66	18.07	208.36	141.47	16.5772	-163.5166
-1658.00	405.18	189.95	15.39	-13.31	125.66	18.16	208.85	141.69	16.5771	-163.5184
-1657.00	405.42	189.86	15.35	-13.31	125.36	18.43	208.74	142.39	16.5746	-163.5163
-1656.00	405.66	189.83	15.20	-13.31	125.66	18.56	208.79	142.74	16.5736	-163.5168
-1655.00	405.90	189.81	15.35	-13.31	125.16	18.66	208.76	143.18	16.5728	-163.5185
-1654.00	406.15	189.90	15.23	-13.31	125.14	18.94	209.21	143.17	16.5703	-163.5186
-1653.00	406.37	189.79	15.23	-13.31	125.56	19.27	209.28	143.59	16.5697	-163.5181

-1652.00	406.62	189.81	19.00	1.09	-19.13	161.77	19.16	471.78	183.80	16.5683	-169.5154
-1651.00	406.87	189.87	19.02	0.99	-19.40	161.96	19.33	472.41	183.99	16.5682	-169.5164
-1650.00	407.12	189.90	19.04	1.03	-19.68	162.35	19.51	473.05	184.28	16.5681	-169.5155
-1649.00	407.36	189.90	19.08	1.07	-19.90	162.84	19.62	473.31	184.57	16.5682	-169.5155
-1648.00	407.57	189.90	19.07	1.00	-19.10	162.54	19.83	474.54	184.64	16.5674	-169.5157
-1647.00	407.77	189.78	19.14	1.17	-19.83	162.54	19.86	476.73	185.15	16.5672	-169.5148
-1646.00	407.99	189.78	19.16	1.15	-19.97	165.33	20.01	476.90	185.36	16.5609	-169.5149
-1645.00	408.20	189.79	19.24	1.07	-19.97	165.94	19.95	478.92	185.98	16.5614	-169.5158
-1644.00	408.40	189.79	19.18	1.05	-20.78	165.62	20.30	478.86	185.65	16.5583	-169.5159
-1643.00	408.62	189.91	19.23	0.90	-20.31	166.04	20.33	478.24	186.07	16.5580	-169.5173
-1642.00	408.83	189.79	19.29	1.01	-20.35	166.54	20.36	480.87	186.57	16.5576	-169.5161
-1641.00	409.07	189.79	19.28	0.97	-20.60	166.54	20.36	480.84	186.56	16.5554	-169.5166
-1640.00	409.24	189.76	19.28	1.13	-20.96	166.17	20.99	479.68	186.21	16.5523	-169.5164
-1639.00	409.48	189.77	19.21	1.00	-21.27	166.11	21.74	479.50	186.15	16.5500	-169.5164
-1638.00	409.60	189.75	19.23	1.17	-21.26	166.39	21.29	480.41	186.43	16.5496	-169.5148
-1637.00	409.86	189.74	19.27	1.15	-21.51	166.64	21.54	480.58	186.48	16.5474	-169.5150
-1636.00	409.97	189.75	19.26	1.22	-21.63	166.79	21.52	481.71	186.83	16.5476	-169.5153
-1635.00	410.37	189.77	19.31	0.94	-21.93	167.19	21.56	483.04	187.23	16.5472	-169.5169
-1634.00	410.70	189.72	19.29	1.23	-21.80	167.08	21.84	482.67	187.12	16.5448	-169.5162
-1633.00	410.54	189.72	19.31	1.24	-21.90	167.30	21.93	483.39	187.36	16.5440	-169.5162
-1632.00	410.69	189.75	19.29	1.02	-22.06	167.25	22.07	483.23	187.29	16.5477	-169.5162
-1631.00	410.66	189.74	19.31	1.08	-22.17	167.41	22.70	483.77	187.45	16.5416	-169.5156
-1630.00	411.01	189.72	19.31	1.14	-22.34	167.40	22.37	483.73	187.44	16.5401	-169.5151
-1629.00	411.16	189.72	19.28	1.12	-22.53	167.94	22.56	483.51	187.38	16.5384	-169.5153
-1628.00	411.32	189.72	19.28	1.10	-22.64	167.49	22.66	483.01	187.53	16.5375	-169.5155
-1627.00	411.46	189.68	19.27	1.36	-22.89	167.38	22.93	483.66	187.42	16.5353	-169.5131
-1626.00	411.62	189.69	19.29	1.30	-22.93	167.67	22.97	483.44	187.66	16.5349	-169.5136
-1625.00	411.79	189.71	19.30	1.13	-23.05	167.72	23.07	485.78	187.76	16.5339	-169.5152
-1624.00	411.90	189.74	19.33	0.92	-23.02	167.97	23.04	485.61	188.02	16.5341	-169.5171
-1623.00	412.05	189.71	19.31	1.10	-23.25	167.87	23.28	485.29	187.92	16.5321	-169.5154
-1622.00	412.19	189.73	19.28	0.93	-23.44	167.70	23.46	484.74	187.75	16.5304	-169.5170
-1621.00	412.30	189.69	19.24	1.13	-23.68	167.51	23.71	484.09	187.55	16.5283	-169.5151
-1620.00	412.46	189.67	19.25	1.29	-23.90	167.67	23.83	484.63	187.72	16.5272	-169.5137
-1619.00	412.56	189.65	19.26	1.39	-23.90	167.75	23.94	484.88	187.79	16.5264	-169.5128
-1618.00	412.67	189.68	19.28	1.16	-23.89	167.94	23.92	485.52	187.99	16.5265	-169.5149
-1617.00	412.80	189.65	19.27	1.31	-24.28	167.40	24.31	483.75	187.45	16.5230	-169.5135
-1616.00	412.91	189.64	19.21	1.40	-24.35	167.56	24.39	484.28	187.61	16.5224	-169.5127
-1615.00	413.01	189.64	19.15	1.34	-24.60	167.19	24.64	483.04	187.23	16.5201	-169.5133
-1614.00	413.16	189.53	19.12	2.04	-24.94	167.03	25.02	482.56	187.08	16.5172	-169.5069
-1613.00	413.22	189.64	19.11	1.27	-24.88	167.02	25.04	482.52	187.07	16.5177	-169.5139
-1612.00	413.34	189.65	19.10	1.22	-25.01	166.99	25.04	482.41	187.04	16.5165	-169.5144
-1611.00	413.42	189.67	19.10	1.08	-25.07	166.99	25.10	482.40	187.04	16.5160	-169.5154
-1610.00	413.51	189.64	19.07	1.20	-25.24	166.86	25.27	481.99	186.91	16.5145	-169.5145
-1609.00	413.61	189.63	19.03	1.27	-25.44	166.62	25.48	481.19	186.67	16.5126	-169.5119
-1608.00	413.74	189.63	19.03	1.24	-25.56	166.59	25.59	481.42	186.74	16.5116	-169.5141
-1607.00	413.77	189.63	18.97	1.20	-25.76	166.26	25.79	480.02	186.31	16.5099	-169.5145
-1606.00	413.81	189.60	18.95	1.43	-25.93	166.17	25.97	479.73	186.22	16.5084	-169.5125
-1605.00	413.91	189.60	18.94	1.40	-26.00	166.12	26.04	479.58	186.18	16.5077	-169.5127
-1604.00	413.97	189.60	18.92	1.38	-26.12	166.01	26.16	479.21	186.06	16.5066	-169.5129
-1603.00	414.06	189.61	18.87	1.29	-26.28	165.75	26.31	478.34	185.80	16.5052	-169.5137
-1602.00	414.14	189.63	18.87	1.10	-26.46	165.43	26.49	477.33	185.49	16.5036	-169.5154

-1540.00	413.60	189.47	15.66	1.25	-34.14	172.65	36.16	609.88	172.69	16.5183	-169.5150
-1541.00	413.31	189.61	15.30	1.36	-34.73	171.89	35.26	609.18	171.98	16.5335	-169.5130
-1542.00	413.24	189.60	15.26	1.35	-34.67	171.97	34.49	609.31	171.85	16.5413	-169.5131
-1543.00	413.17	189.36	15.22	1.62	-34.71	172.71	34.55	606.44	170.81	16.5409	-169.5106
-1544.00	413.08	189.37	15.09	1.66	-34.73	172.79	34.31	614.31	172.41	16.5292	-169.5123
-1545.00	412.98	189.39	15.02	1.60	-34.75	172.28	34.78	611.64	171.37	16.5287	-169.5126
-1546.00	412.90	189.38	14.86	1.43	-34.85	172.13	35.07	607.80	171.24	16.5260	-169.5127
-1547.00	412.82	189.41	14.74	1.18	-34.89	172.61	35.11	607.69	171.71	16.5256	-169.5127
-1548.00	412.72	189.41	14.61	1.50	-34.91	172.56	35.61	602.66	171.71	16.5230	-169.5117
-1549.00	412.64	189.36	14.53	1.86	-34.92	172.82	35.55	602.30	171.92	16.5217	-169.5121
-1550.00	412.54	189.35	14.44	1.40	-34.96	172.14	35.67	612.04	171.04	16.5206	-169.5117
-1551.00	412.54	189.39	14.40	1.26	-34.97	172.82	35.61	617.95	171.25	16.5210	-169.5137
-1552.00	412.34	189.35	14.21	1.69	-34.98	172.82	35.78	617.18	171.62	16.5179	-169.5110
-1553.00	412.27	189.38	14.15	1.27	-34.96	172.05	35.99	612.26	171.15	16.5176	-169.5116
-1554.00	412.15	189.34	14.06	1.52	-34.97	172.05	36.31	607.03	171.87	16.5166	-169.5116
-1555.00	412.07	189.33	14.03	1.50	-34.98	172.83	36.51	602.84	171.87	16.5166	-169.5116
-1556.00	411.94	189.33	14.03	1.50	-34.98	172.83	36.56	602.84	172.44	16.5124	-169.5117
-1557.00	411.86	189.34	14.06	1.41	-34.93	172.83	36.62	602.96	172.44	16.5124	-169.5117
-1558.00	411.76	189.34	14.06	1.41	-34.93	172.83	36.67	602.96	172.44	16.5124	-169.5117
-1559.00	411.65	189.33	14.52	1.39	-34.94	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1560.00	411.53	189.33	14.42	1.43	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1561.00	411.45	189.33	14.30	1.64	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1562.00	411.45	189.33	14.30	1.64	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1563.00	411.35	189.33	14.06	1.43	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1564.00	411.23	189.32	14.64	1.63	-34.96	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1565.00	411.12	189.32	14.54	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1566.00	411.02	189.31	14.64	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1567.00	410.91	189.31	14.64	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1568.00	410.80	189.30	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1569.00	410.69	189.28	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1570.00	410.58	189.28	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1571.00	410.47	189.27	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1572.00	410.36	189.27	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1573.00	410.27	189.30	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1574.00	410.13	189.27	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1575.00	410.03	189.27	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1576.00	409.92	189.25	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1577.00	409.82	189.25	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1578.00	409.70	189.24	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1579.00	409.62	189.24	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
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-1581.00	409.40	189.22	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1582.00	409.27	189.22	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1583.00	409.18	189.23	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1584.00	409.14	189.22	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1585.00	409.16	189.22	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1586.00	409.16	189.22	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1587.00	409.16	189.22	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1588.00	409.16	189.22	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1589.00	409.16	189.22	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116
-1590.00	409.16	189.22	14.56	1.63	-34.97	172.84	36.76	602.96	172.44	16.5105	-169.5116

167,430 - 169,525
19,917 - 168,910
19,271 - 168,911

3,000
63,700

3,660,000
8,660,000

5,330,000
14,390,000

Probe No. 3; lift-off time: H-50 seconds; and project No. 6.13

Raw data referenced to the ship		Quantities have been translated to the launcher position									
Time, sec	Range, km	Azimuth, deg T	Elevation, deg Geod.	x, km distance east	y, km distance north	z at launcher	$\sqrt{x^2 + y^2}$, km	Height above earth, kft	Height above earth, km	Latitude of target, deg	Longitude of target, deg

-13.00	354.89	191.05	5.04	-1.55	6.45	40.98	6.63	134.47	40.99	16.7936	-169.5400
-12.00	354.80	191.08	5.34	-1.63	6.43	42.82	7.02	140.48	42.82	16.7970	-169.5407
-11.00	354.72	191.11	5.66	-1.76	6.44	44.75	7.45	146.82	44.75	16.8007	-169.5419
-10.00	354.65	191.17	6.06	-1.91	6.45	46.65	7.91	152.47	46.65	16.8037	-169.5414
-9.00	354.59	191.13	6.25	-1.93	6.45	48.32	8.33	158.34	48.32	16.8071	-169.5413
-8.00	354.54	191.15	6.51	-1.77	6.45	50.03	8.53	164.18	50.04	16.8104	-169.5420
-7.00	354.49	191.15	6.80	-1.74	6.45	51.66	8.82	169.53	51.67	16.8134	-169.5417
-6.00	354.45	191.18	7.11	-1.86	6.45	53.56	9.24	175.73	53.56	16.8170	-169.5427
-5.00	354.42	191.22	7.39	-2.00	6.44	55.27	9.66	181.37	55.28	16.8204	-169.5441
-4.00	354.40	191.24	7.67	-2.07	6.40	56.97	10.02	186.94	56.98	16.8237	-169.5448
-3.00	354.33	191.26	7.97	-2.12	10.19	58.79	10.40	192.93	58.80	16.8272	-169.5452
-2.00	354.38	191.26	8.25	-2.03	10.52	60.47	10.71	198.43	60.48	16.8302	-169.5444
-1.00	354.39	191.27	8.52	-2.07	10.97	62.11	11.06	203.81	62.12	16.8333	-169.5447
0.	354.39	191.30	8.81	-2.16	11.26	63.88	11.46	209.62	63.89	16.8368	-169.5455
1.00	354.40	191.31	9.08	-2.14	11.60	65.51	11.80	214.96	65.52	16.8398	-169.5454
2.00	354.42	191.34	9.36	-2.26	11.93	67.21	12.20	220.55	67.22	16.8433	-169.5465
3.00	354.45	191.37	9.63	-2.41	12.36	68.84	12.59	225.89	68.85	16.8466	-169.5479
4.00	354.48	191.39	9.90	-2.63	12.71	70.48	12.95	231.24	70.48	16.8498	-169.5481
5.00	354.53	191.41	10.20	-2.51	13.11	72.25	13.35	237.08	72.26	16.8533	-169.5488
6.00	354.57	191.41	10.54	-2.68	13.41	73.71	13.64	241.87	73.72	16.8560	-169.5485
7.00	354.63	191.44	10.75	-2.53	13.45	75.63	13.88	248.19	75.65	16.8600	-169.5489
8.00	354.68	191.45	11.02	-2.56	14.20	77.21	14.43	253.99	77.23	16.8631	-169.5492
9.00	354.75	191.48	11.30	-2.66	14.70	78.92	14.86	258.99	78.94	16.8666	-169.5501
10.00	354.82	191.52	11.54	-2.84	14.96	80.41	15.23	263.88	80.43	16.8698	-169.5520
11.00	354.89	191.53	11.80	-2.84	15.31	81.97	15.57	269.00	81.99	16.8729	-169.5518
12.00	354.97	191.56	12.08	-2.91	15.70	83.66	15.97	274.33	83.68	16.8764	-169.5525
13.00	355.06	191.58	12.33	-2.97	16.04	85.16	16.31	279.46	85.18	16.8795	-169.5530
14.00	355.15	191.60	12.57	-3.05	16.39	86.65	16.67	284.34	86.67	16.8827	-169.5537
15.00	355.25	191.61	12.83	-3.02	16.74	88.20	17.01	289.44	88.22	16.8856	-169.5535
16.00	355.35	191.65	13.14	-3.19	17.22	89.70	17.51	295.63	90.11	16.8899	-169.5550
17.00	355.46	191.66	13.31	-3.22	17.43	91.13	17.72	299.08	91.16	16.8918	-169.5553
18.00	355.56	191.69	13.64	-3.33	17.94	93.11	18.25	305.56	93.13	16.8963	-169.5563
19.00	355.69	191.72	13.91	-3.43	18.35	94.74	18.67	310.92	94.77	16.8999	-169.5572
20.00	355.80	191.74	14.13	-3.50	19.66	96.10	18.99	315.38	96.13	16.9027	-169.5578
21.00	355.92	191.75	14.38	-3.49	19.02	97.63	19.34	320.39	97.66	16.9059	-169.5578
22.00	356.01	191.66	14.64	-2.88	19.12	99.19	19.53	325.52	99.22	16.9085	-169.5522
23.00	356.04	191.29	14.67	-0.66	18.89	99.34	18.99	326.07	99.39	16.9047	-169.5316

0 0 100.00 -10000.00 280.00 3.00 1.00
 16.7350 -169.5254 3.2000 20224628.90 20555948.50
 19.9100 -168.9080 40.0000 991806.00 1002300.00
 12.9101 -168.9085

Probe No. 4; lift-off time: H710 seconds; and project No. 6.13

Raw data referenced to the ship		Quantities have been translated to the launcher position									
Time, sec	Range, km	Azimuth, deg T	Elevation, deg Geod.	x, km distance east	y, km distance north	z at launcher	$\sqrt{x^2 + y^2}$, km	Height above earth, kft	Height above earth, km	Latitude of target, deg R	Longitude of target, deg

701.00	701.65	114.00	12.54	1.64	198.7	93.36	215.57	311.95	95.07	16.5773	169.6957
702.00	702.65	113.41	12.98	1.64	198.0	93.00	214.87	312.07	96.89	16.5667	169.7046
703.00	703.65	112.81	13.42	1.64	197.3	92.64	214.19	312.19	98.71	16.5557	169.7135
704.00	704.65	112.21	13.86	1.64	196.6	92.28	213.51	312.31	100.53	16.5447	169.7224
705.00	705.65	111.61	14.30	1.64	195.9	91.92	212.83	312.43	102.35	16.5337	169.7313
706.00	706.65	111.01	14.74	1.64	195.2	91.56	212.15	312.55	104.17	16.5227	169.7402
707.00	707.65	110.41	15.18	1.64	194.5	91.20	211.47	312.67	105.99	16.5117	169.7491
708.00	708.65	109.81	15.62	1.64	193.8	90.84	210.79	312.79	107.81	16.5007	169.7580
709.00	709.65	109.21	16.06	1.64	193.1	90.48	210.11	312.91	109.63	16.4897	169.7669
710.00	710.65	108.61	16.50	1.64	192.4	90.12	209.43	313.03	111.45	16.4787	169.7758
711.00	711.65	108.01	16.94	1.64	191.7	89.76	208.75	313.15	113.27	16.4677	169.7847
712.00	712.65	107.41	17.38	1.64	191.0	89.40	208.07	313.27	115.09	16.4567	169.7936
713.00	713.65	106.81	17.82	1.64	190.3	89.04	207.39	313.39	116.91	16.4457	169.8025
714.00	714.65	106.21	18.26	1.64	189.6	88.68	206.71	313.51	118.73	16.4347	169.8114
715.00	715.65	105.61	18.70	1.64	188.9	88.32	206.03	313.63	120.55	16.4237	169.8203
716.00	716.65	105.01	19.14	1.64	188.2	87.96	205.35	313.75	122.37	16.4127	169.8292
717.00	717.65	104.41	19.58	1.64	187.5	87.60	204.67	313.87	124.19	16.4017	169.8381
718.00	718.65	103.81	20.02	1.64	186.8	87.24	203.99	313.99	126.01	16.3907	169.8470
719.00	719.65	103.21	20.46	1.64	186.1	86.88	203.31	314.11	127.83	16.3797	169.8559
720.00	720.65	102.61	20.90	1.64	185.4	86.52	202.63	314.23	129.65	16.3687	169.8648
721.00	721.65	102.01	21.34	1.64	184.7	86.16	201.95	314.35	131.47	16.3577	169.8737
722.00	722.65	101.41	21.78	1.64	184.0	85.80	201.27	314.47	133.29	16.3467	169.8826
723.00	723.65	100.81	22.22	1.64	183.3	85.44	200.59	314.59	135.11	16.3357	169.8915
724.00	724.65	100.21	22.66	1.64	182.6	85.08	199.91	314.71	136.93	16.3247	169.9004
725.00	725.65	99.61	23.10	1.64	181.9	84.72	199.23	314.83	138.75	16.3137	169.9093
726.00	726.65	99.01	23.54	1.64	181.2	84.36	198.55	314.95	140.57	16.3027	169.9182
727.00	727.65	98.41	23.98	1.64	180.5	84.00	197.87	315.07	142.39	16.2917	169.9271
728.00	728.65	97.81	24.42	1.64	179.8	83.64	197.19	315.19	144.21	16.2807	169.9360
729.00	729.65	97.21	24.86	1.64	179.1	83.28	196.51	315.31	146.03	16.2697	169.9449
730.00	730.65	96.61	25.30	1.64	178.4	82.92	195.83	315.43	147.85	16.2587	169.9538
731.00	731.65	96.01	25.74	1.64	177.7	82.56	195.15	315.55	149.67	16.2477	169.9627
732.00	732.65	95.41	26.18	1.64	177.0	82.20	194.47	315.67	151.49	16.2367	169.9716
733.00	733.65	94.81	26.62	1.64	176.3	81.84	193.79	315.79	153.31	16.2257	169.9805
734.00	734.65	94.21	27.06	1.64	175.6	81.48	193.11	315.91	155.13	16.2147	169.9894
735.00	735.65	93.61	27.50	1.64	174.9	81.12	192.43	316.03	156.95	16.2037	169.9983
736.00	736.65	93.01	27.94	1.64	174.2	80.76	191.75	316.15	158.77	16.1927	170.0072
737.00	737.65	92.41	28.38	1.64	173.5	80.40	191.07	316.27	160.59	16.1817	170.0161
738.00	738.65	91.81	28.82	1.64	172.8	80.04	190.39	316.39	162.41	16.1707	170.0250
739.00	739.65	91.21	29.26	1.64	172.1	79.68	189.71	316.51	164.23	16.1597	170.0339
740.00	740.65	90.61	29.70	1.64	171.4	79.32	189.03	316.63	166.05	16.1487	170.0428
741.00	741.65	90.01	30.14	1.64	170.7	78.96	188.35	316.75	167.87	16.1377	170.0517
742.00	742.65	89.41	30.58	1.64	170.0	78.60	187.67	316.87	169.69	16.1267	170.0606
743.00	743.65	88.81	31.02	1.64	169.3	78.24	187.00	316.99	171.51	16.1157	170.0695
744.00	744.65	88.21	31.46	1.64	168.6	77.88	186.32	317.11	173.33	16.1047	170.0784
745.00	745.65	87.61	31.90	1.64	167.9	77.52	185.64	317.23	175.15	16.0937	170.0873
746.00	746.65	87.01	32.34	1.64	167.2	77.16	184.97	317.35	176.97	16.0827	170.0962
747.00	747.65	86.41	32.78	1.64	166.5	76.80	184.29	317.47	178.79	16.0717	170.1051
748.00	748.65	85.81	33.22	1.64	165.8	76.44	183.61	317.59	180.61	16.0607	170.1140
749.00	749.65	85.21	33.66	1.64	165.1	76.08	182.94	317.71	182.43	16.0497	170.1229
750.00	750.65	84.61	34.10	1.64	164.4	75.72	182.26	317.83	184.25	16.0387	170.1318

884.00	467.39	191.93	24.13	-22.75	-54.41	204.75	58.98	672.62	205.01	16.2418
885.00	467.99	191.74	24.18	-22.86	-54.75	204.38	59.33	674.71	205.65	16.2590
886.00	468.59	191.54	24.21	-22.99	-55.17	204.04	59.77	676.81	206.11	16.2553
887.00	469.19	191.37	24.23	-23.14	-55.56	203.78	60.24	678.97	206.54	16.2519
888.00	469.78	191.26	24.26	-23.34	-55.96	203.54	60.64	681.11	207.06	16.2484
889.00	470.36	191.08	24.31	-23.55	-56.38	203.31	61.01	683.47	207.66	16.2457
890.00	470.95	191.09	24.36	-23.65	-56.58	203.03	61.33	685.67	208.32	16.2431
891.00	471.53	191.00	24.41	-23.81	-56.86	202.70	61.65	688.06	208.99	16.2408
892.00	472.10	192.02	24.45	-24.02	-57.19	202.24	62.03	690.53	209.53	16.2379
893.00	472.67	192.01	24.48	-24.19	-57.57	201.74	62.45	693.05	209.99	16.2347
894.00	473.24	192.02	24.52	-24.15	-57.91	210.26	62.76	695.60	210.56	16.2316
895.00	473.80	192.01	24.56	-24.15	-58.24	210.80	63.13	698.20	211.10	16.2289
896.00	474.36	192.04	24.60	-24.49	-58.57	211.34	63.49	700.84	211.65	16.2260
897.00	474.92	192.07	24.67	-24.78	-58.91	211.79	63.91	703.51	212.23	16.2231
898.00	475.47	192.06	24.65	-24.80	-59.28	212.27	64.26	706.24	212.58	16.2199
899.00	476.01	192.07	24.67	-24.92	-59.68	212.66	64.67	709.04	212.98	16.2165
900.00	476.56	192.07	24.70	-25.01	-60.01	213.14	65.03	711.94	213.46	16.2135
901.00	477.09	192.10	24.72	-25.31	-60.37	213.52	65.47	714.91	213.85	16.2105
902.00	477.63	192.13	24.76	-25.63	-60.63	214.07	65.83	717.91	214.40	16.2083
903.00	478.16	192.14	24.78	-25.78	-60.98	214.51	66.20	720.94	214.84	16.2053
904.00	478.68	192.13	24.81	-25.80	-61.26	215.04	66.47	724.06	215.42	16.2028
905.00	479.20	192.12	24.84	-25.75	-61.68	215.44	66.84	727.25	215.78	16.1993
906.00	479.72	192.13	24.85	-25.91	-62.08	215.76	67.21	730.51	216.10	16.1958
907.00	480.23	192.15	24.87	-26.21	-62.51	216.12	67.69	733.84	216.47	16.1930
908.00	480.74	192.17	24.88	-26.40	-62.78	216.44	68.10	737.28	216.80	16.1898
909.00	481.24	192.16	24.91	-26.60	-63.12	216.87	68.43	740.80	217.23	16.1867
910.00	481.75	192.18	24.90	-26.65	-63.55	217.06	68.91	744.33	217.42	16.1830
911.00	482.24	192.19	24.92	-26.83	-63.87	217.46	69.27	747.91	217.83	16.1803
912.00	482.73	192.21	24.92	-27.07	-64.26	217.68	69.73	751.50	218.05	16.1769
913.00	483.21	192.21	24.95	-27.12	-64.56	218.14	70.03	755.11	218.51	16.1743
914.00	483.70	192.22	24.97	-27.23	-64.90	218.51	70.38	758.89	218.89	16.1714
915.00	484.18	192.22	25.00	-27.37	-65.19	218.94	70.70	762.71	219.33	16.1689
916.00	484.65	192.24	25.01	-27.56	-65.53	219.24	71.09	766.59	219.63	16.1659
917.00	485.12	192.23	25.02	-27.59	-65.83	219.56	71.44	770.51	219.95	16.1627
918.00	485.59	192.26	25.04	-27.86	-66.19	219.90	71.82	774.48	220.30	16.1602
919.00	486.04	192.26	25.04	-28.01	-66.52	220.13	72.22	778.51	220.53	16.1570
920.00	486.50	192.28	25.04	-28.20	-66.92	220.37	72.62	782.62	220.77	16.1539
921.00	486.95	192.30	25.05	-28.40	-67.25	220.64	73.00	786.80	221.05	16.1510
922.00	487.40	192.30	25.05	-28.48	-67.65	220.84	73.40	791.04	221.25	16.1476
923.00	487.84	192.30	25.06	-28.57	-67.97	221.15	73.73	795.34	221.57	16.1448
924.00	488.28	192.29	25.06	-28.60	-68.19	221.30	74.13	799.71	221.72	16.1412
925.00	488.71	192.31	25.05	-28.64	-68.39	221.49	74.54	804.14	221.92	16.1382
926.00	489.14	192.33	25.05	-29.08	-69.07	221.70	74.95	808.62	222.13	16.1353
927.00	489.57	192.36	25.07	-29.35	-69.33	222.02	75.29	813.16	222.45	16.1306
928.00	489.99	192.36	25.09	-29.52	-69.62	222.36	75.58	817.84	222.80	16.1269
929.00	490.41	192.34	25.09	-29.52	-70.04	222.53	75.93	822.57	222.97	16.1238
930.00	490.82	192.36	25.08	-29.53	-70.19	222.66	76.34	827.34	223.10	16.1208
931.00	491.23	192.36	25.08	-29.63	-70.74	222.86	76.69	832.16	223.31	16.1178
932.00	491.63	192.37	25.08	-29.79	-71.09	223.01	77.08	837.04	223.46	16.1157
933.00	492.02	192.39	25.09	-30.04	-71.33	223.30	77.40	841.97	223.76	16.1122
934.00	492.42	192.47	25.06	-30.34	-71.74	223.78	77.89	846.94	223.74	16.1095

Probe No. 5; 11ft-off time: H+1200 seconds; and project No. 6.2

Raw data referenced to the ship		Quantities have been translated to the launcher position										
Time, sec	Range, km	Azimuth, deg T	Elevation, deg	Coord.	x, km distance east	y, km distance north	z at launcher	$\sqrt{x^2 + y^2}$, km	Height above earth, kft	Height above earth, km	Latitude of target, deg	Longitude of target, deg

1292-00	343-60	188-71	12-63	14-44	24-91	83-81	28-70	275-17	83-87	16-9585
1293-00	343-22	188-19	13-25	16-73	26-20	87-26	10-13	286-54	87-34	16-9707
1294-00	347-84	188-17	13-63	15-04	27-55	89-76	31-12	288-11	89-34	16-9872
1295-00	342-07	188-10	13-99	15-54	28-71	91-26	32-20	299-88	91-40	16-9877
1296-00	347-08	188-03	14-37	16-16	29-19	93-37	33-33	306-60	93-45	16-9864
1297-00	341-68	187-83	14-75	16-16	30-16	95-17	34-51	313-10	95-46	17-0051
1298-00	341-29	187-83	15-14	17-52	31-17	97-47	35-76	320-12	97-57	17-0140
1299-00	340-90	187-76	15-56	18-09	32-28	99-74	37-00	327-58	99-85	17-0238
1300-00	340-51	187-71	16-00	18-52	33-65	102-05	38-23	335-19	102-17	17-0341
1301-00	340-12	187-64	16-46	19-13	34-67	104-54	39-60	343-17	104-66	17-0448
1302-00	339-75	187-54	16-92	19-83	35-86	106-97	40-98	351-37	107-10	17-0554
1303-00	339-38	187-46	17-41	20-46	37-15	109-56	42-41	359-21	109-70	17-0667
1304-00	339-03	187-38	17-92	21-09	38-58	112-24	43-88	368-75	112-39	17-0785
1305-00	338-69	187-27	18-42	21-82	39-73	114-88	45-41	377-43	115-04	17-0900
1306-00	338-37	187-18	18-95	22-56	41-19	117-66	46-96	386-58	117-83	17-1022
1307-00	338-03	187-08	19-50	23-40	42-62	120-54	48-57	396-09	120-73	17-1148
1308-00	337-80	186-99	20-05	24-03	44-07	123-44	50-19	405-63	123-64	17-1275
1309-00	337-56	186-90	20-63	24-72	45-59	126-48	51-86	415-64	126-69	17-1409
1310-00	337-34	186-81	21-16	25-35	46-99	129-22	53-39	424-67	129-44	17-1532
1311-00	337-16	186-72	21-72	26-05	48-65	132-10	55-01	434-18	132-34	17-1659
1312-00	337-00	186-59	22-24	26-92	49-82	134-83	56-63	443-15	135-07	17-1779
1313-00	336-84	186-47	22-80	27-73	51-29	137-74	58-31	452-76	138-00	17-1908
1314-00	336-76	186-36	23-34	28-49	52-73	140-55	59-93	462-03	140-83	17-2033
1315-00	336-68	186-27	23-91	29-16	54-11	143-25	61-47	470-95	143-55	17-2154
1316-00	336-63	186-20	24-50	29-87	55-57	146-09	63-09	480-30	146-40	17-2281
1317-00	336-61	186-14	25-09	30-57	57-05	148-92	64-69	489-64	149-24	17-2409
1318-00	336-61	186-08	25-69	31-26	58-52	151-59	66-26	498-45	151-93	17-2529
1319-00	336-64	186-03	26-30	32-02	59-93	154-50	67-95	508-05	154-86	17-2660
1320-00	336-70	185-97	26-93	32-76	61-40	157-32	69-59	517-38	157-70	17-2788
1321-00	336-78	185-91	27-58	33-39	62-83	160-05	71-15	526-39	160-44	17-2912
1322-00	336-89	185-85	28-26	34-12	64-30	162-85	72-79	535-62	163-26	17-3039
1323-00	337-02	185-74	28-97	34-77	65-77	165-63	74-40	544-80	166-06	17-3167
1324-00	337-18	185-70	29-71	35-64	67-15	168-28	76-02	553-57	168-73	17-3286
1325-00	337-37	185-17	29-24	36-48	68-57	171-00	77-67	562-53	171-46	17-3409
1326-00	337-58	185-05	29-76	37-22	70-01	173-71	79-28	571-19	174-19	17-3533
1327-00	337-82	184-95	30-29	37-86	71-55	176-41	80-86	580-43	176-92	17-3658
1328-00	338-07	184-86	30-81	38-43	72-99	179-10	82-40	589-30	179-62	17-3782
1329-00	338-36	184-75	31-31	39-15	74-28	181-70	83-96	597-97	182-75	17-3902
1330-00	338-67	184-62	31-83	39-93	75-73	184-42	85-61	606-90	184-98	17-4027
1331-00	339-00	184-48	32-35	40-75	77-16	187-08	87-26	615-70	187-67	17-4150
1332-00	339-35	184-35	32-87	41-50	78-67	189-78	88-90	624-63	190-39	17-4276
1333-00	339-73	184-23	33-39	42-23	80-11	192-50	90-56	633-64	193-13	17-4404
1334-00	340-13	184-11	33-91	42-74	81-60	195-21	92-20	642-59	195-86	17-4531
1335-00	340-55	183-99	34-40	43-64	82-98	197-77	93-76	651-05	198-44	17-4650
1336-00	340-99	183-87	34-90	44-33	84-42	200-40	95-35	659-77	201-10	17-4774
1337-00	341-44	183-75	35-39	45-03	85-33	202-98	96-92	668-29	203-70	17-4894
1338-00	341-95	183-64	35-89	45-67	87-29	205-61	98-52	677-01	206-35	17-5019
1339-00	342-44	183-51	36-38	46-37	88-71	208-20	100-10	685-57	208-96	17-5141
1340-00	342-99	183-35	36-89	47-27	90-20	210-85	101-83	694-36	211-64	17-5268
1341-00	343-54	183-20	37-17	48-06	91-59	213-99	103-43	703-77	214-21	17-5387
1342-00	344-11	183-07	37-85	48-76	93-01	215-94	105-01	711-22	216-78	17-5508

1363.00	344.70	187.95	1.2	4.74	96.67	211.57	106.58	719.67	219.34	175.5679	169.0751
1364.00	345.11	187.93	84.31	3.83	96.67	221.04	108.17	724.12	221.94	175.5679	169.0633
1365.00	345.04	187.92	154.71	3.09	96.67	224.63	109.75	728.66	224.55	175.5679	169.0662
1366.00	344.59	187.90	347.77	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1367.00	347.76	187.86	347.76	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1368.00	347.16	187.87	347.16	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1369.00	349.65	187.79	349.65	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1370.00	349.37	187.79	349.37	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1371.00	350.12	187.78	349.12	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1372.00	351.87	187.74	348.87	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1373.00	351.65	187.55	348.55	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1374.00	352.44	187.51	348.21	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1375.00	353.27	187.43	347.77	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1376.00	354.07	187.33	347.16	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1377.00	354.91	187.25	346.33	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1378.00	355.91	187.18	345.29	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1379.00	357.76	187.04	344.04	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1380.00	358.63	186.94	342.57	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1381.00	359.52	186.84	340.84	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1382.00	360.42	186.74	338.84	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1383.00	361.33	186.64	336.53	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1384.00	362.24	186.54	333.84	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1385.00	363.16	186.44	330.76	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1386.00	364.11	186.34	327.21	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1387.00	365.11	186.24	323.21	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1388.00	366.12	186.14	318.76	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1389.00	367.13	186.04	313.87	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1390.00	368.17	185.94	308.57	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1391.00	369.20	185.84	302.81	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1392.00	370.26	185.74	296.56	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1393.00	371.32	185.64	289.81	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1394.00	372.40	185.54	282.56	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1395.00	373.49	185.44	274.81	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1396.00	374.59	185.34	266.56	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1397.00	375.70	185.24	257.81	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1398.00	376.81	185.14	248.56	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1399.00	377.94	185.04	238.81	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1400.00	379.08	184.94	228.56	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1401.00	380.22	184.84	217.81	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1402.00	381.34	184.74	206.56	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1403.00	382.54	184.64	194.81	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1404.00	383.70	184.54	182.56	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1405.00	384.89	184.44	169.81	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1406.00	386.08	184.34	156.56	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1407.00	387.27	184.24	142.81	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1408.00	388.47	184.14	128.56	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1409.00	389.68	184.04	113.81	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1410.00	390.89	183.94	98.56	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1411.00	392.12	183.84	82.81	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1412.00	393.35	183.74	66.56	31.61	98.19	226.19	111.39	732.18	227.13	175.5679	169.0579
1413.00	174.19	174.19	166.19	166.19	96.67	211.57	106.58	719.67	219.34	175.5679	169.0751

1636.00	659.35	57.08	71.05	347.77	501.15	604.49	554.40	2356.74	676.90	20.8537	167.464
1637.00	659.94	57.80	70.96	347.80	501.15	605.66	559.77	2358.61	677.16	20.8644	167.470
1638.00	660.52	58.54	70.84	347.83	501.15	606.79	561.22	2360.51	677.43	20.8753	167.476
1639.00	661.11	59.38	70.71	347.86	501.15	607.90	562.71	2362.41	677.67	20.8861	167.481
1640.00	661.68	60.24	70.58	347.89	501.15	609.04	564.22	2364.31	677.91	20.8970	167.487
1641.00	662.26	61.11	70.45	347.92	501.15	610.18	565.74	2366.21	678.15	20.9079	167.492
1642.00	662.82	62.00	70.32	347.95	501.15	611.32	567.27	2368.11	678.39	20.9188	167.498
1643.00	663.39	62.91	70.19	347.98	501.15	612.46	568.80	2370.01	678.63	20.9297	167.503
1644.00	663.94	63.84	70.06	348.01	501.15	613.60	570.34	2371.91	678.87	20.9406	167.509
1645.00	664.50	64.78	69.93	348.04	501.15	614.74	571.83	2373.81	679.11	20.9515	167.514
1646.00	665.05	65.74	69.80	348.07	501.15	615.88	573.32	2375.71	679.35	20.9624	167.520
1647.00	665.59	66.71	69.67	348.10	501.15	617.02	574.81	2377.61	679.59	20.9733	167.525
1648.00	666.13	67.69	69.54	348.13	501.15	618.16	576.30	2379.51	679.83	20.9842	167.531
1649.00	666.66	68.68	69.41	348.16	501.15	619.30	577.79	2381.41	680.07	20.9951	167.536
1650.00	667.22	69.68	69.28	348.19	501.15	620.44	579.28	2383.31	680.31	21.0060	167.542
1651.00	667.77	70.69	69.15	348.22	501.15	621.58	580.77	2385.21	680.55	21.0169	167.547
1652.00	668.33	71.71	69.02	348.25	501.15	622.72	582.26	2387.11	680.79	21.0278	167.553
1653.00	668.87	72.74	68.89	348.28	501.15	623.86	583.75	2389.01	681.03	21.0387	167.558
1654.00	669.42	73.78	68.76	348.31	501.15	625.00	585.24	2390.91	681.27	21.0496	167.564
1655.00	669.96	74.83	68.63	348.34	501.15	626.14	586.73	2392.81	681.51	21.0605	167.569
1656.00	670.50	75.88	68.50	348.37	501.15	627.28	588.22	2394.71	681.75	21.0714	167.575
1657.00	671.04	76.94	68.37	348.40	501.15	628.42	589.71	2396.61	682.00	21.0823	167.580
1658.00	671.58	78.01	68.24	348.43	501.15	629.56	591.20	2398.51	682.24	21.0932	167.586
1659.00	672.12	79.08	68.11	348.46	501.15	630.70	592.69	2400.41	682.48	21.1041	167.591
1660.00	672.66	80.16	67.98	348.49	501.15	631.84	594.18	2402.31	682.72	21.1150	167.597
1661.00	673.20	81.24	67.85	348.52	501.15	632.98	595.67	2404.21	682.96	21.1259	167.602
1662.00	673.74	82.33	67.72	348.55	501.15	634.12	597.16	2406.11	683.20	21.1368	167.608
1663.00	674.28	83.42	67.59	348.58	501.15	635.26	598.65	2408.01	683.44	21.1477	167.613
1664.00	674.82	84.51	67.46	348.61	501.15	636.40	600.14	2409.91	683.68	21.1586	167.619
1665.00	675.36	85.60	67.33	348.64	501.15	637.54	601.63	2411.81	683.92	21.1695	167.624
1666.00	675.90	86.70	67.20	348.67	501.15	638.68	603.12	2413.71	684.16	21.1804	167.630
1667.00	676.44	87.80	67.07	348.70	501.15	639.82	604.61	2415.61	684.40	21.1913	167.635
1668.00	676.98	88.90	66.94	348.73	501.15	640.96	606.10	2417.51	684.64	21.2022	167.641
1669.00	677.52	89.99	66.81	348.76	501.15	642.10	607.59	2419.41	684.88	21.2131	167.646
1670.00	678.06	91.09	66.68	348.79	501.15	643.24	609.08	2421.31	685.12	21.2240	167.652
1671.00	678.60	92.19	66.55	348.82	501.15	644.38	610.57	2423.21	685.36	21.2349	167.657
1672.00	679.14	93.29	66.42	348.85	501.15	645.52	612.06	2425.11	685.60	21.2458	167.663
1673.00	679.68	94.39	66.29	348.88	501.15	646.66	613.55	2427.01	685.84	21.2567	167.668
1674.00	680.22	95.49	66.16	348.91	501.15	647.80	615.04	2428.91	686.08	21.2676	167.674
1675.00	680.76	96.59	66.03	348.94	501.15	648.94	616.53	2430.81	686.32	21.2785	167.679
1676.00	681.30	97.69	65.90	348.97	501.15	650.08	618.02	2432.71	686.56	21.2894	167.685
1677.00	681.84	98.79	65.77	349.00	501.15	651.22	619.51	2434.61	686.80	21.3003	167.690
1678.00	682.38	99.89	65.64	349.03	501.15	652.36	621.00	2436.51	687.04	21.3112	167.696
1679.00	682.92	100.99	65.51	349.06	501.15	653.50	622.49	2438.41	687.28	21.3221	167.701
1680.00	683.46	102.09	65.38	349.09	501.15	654.64	623.98	2440.31	687.52	21.3330	167.707
1681.00	684.00	103.19	65.25	349.12	501.15	655.78	625.47	2442.21	687.76	21.3439	167.712
1682.00	684.54	104.29	65.12	349.15	501.15	656.92	626.96	2444.11	688.00	21.3548	167.718
1683.00	685.08	105.39	64.99	349.18	501.15	658.06	628.45	2446.01	688.24	21.3657	167.723
1684.00	685.62	106.49	64.86	349.21	501.15	659.20	629.94	2447.91	688.48	21.3766	167.729
1685.00	686.16	107.59	64.73	349.24	501.15	660.34	631.43	2449.81	688.72	21.3875	167.734
1686.00	686.70	108.69	64.60	349.27	501.15	661.48	632.92	2451.71	688.96	21.3984	167.740

1687.00	683.43	504.95	664.23	674.11	674.06	2036.63	673.46	31.3365	166.1975
1688.00	683.74	504.96	664.23	674.11	674.06	2036.66	673.46	31.3365	166.1975
1689.00	684.05	504.97	664.23	674.11	674.06	2036.69	673.46	31.3365	166.1975
1690.00	684.36	504.98	664.23	674.11	674.06	2036.72	673.46	31.3365	166.1975
1691.00	684.67	504.99	664.23	674.11	674.06	2036.75	673.46	31.3365	166.1975
1692.00	684.98	505.00	664.23	674.11	674.06	2036.78	673.46	31.3365	166.1975
1693.00	685.29	505.01	664.23	674.11	674.06	2036.81	673.46	31.3365	166.1975
1694.00	685.60	505.02	664.23	674.11	674.06	2036.84	673.46	31.3365	166.1975
1695.00	685.91	505.03	664.23	674.11	674.06	2036.87	673.46	31.3365	166.1975
1696.00	686.22	505.04	664.23	674.11	674.06	2036.90	673.46	31.3365	166.1975
1697.00	686.53	505.05	664.23	674.11	674.06	2036.93	673.46	31.3365	166.1975
1698.00	686.84	505.06	664.23	674.11	674.06	2036.96	673.46	31.3365	166.1975
1699.00	687.15	505.07	664.23	674.11	674.06	2036.99	673.46	31.3365	166.1975
1700.00	687.46	505.08	664.23	674.11	674.06	2037.02	673.46	31.3365	166.1975
1701.00	687.77	505.09	664.23	674.11	674.06	2037.05	673.46	31.3365	166.1975
1702.00	688.08	505.10	664.23	674.11	674.06	2037.08	673.46	31.3365	166.1975
1703.00	688.39	505.11	664.23	674.11	674.06	2037.11	673.46	31.3365	166.1975
1704.00	688.70	505.12	664.23	674.11	674.06	2037.14	673.46	31.3365	166.1975
1705.00	689.01	505.13	664.23	674.11	674.06	2037.17	673.46	31.3365	166.1975
1706.00	689.32	505.14	664.23	674.11	674.06	2037.20	673.46	31.3365	166.1975
1707.00	689.63	505.15	664.23	674.11	674.06	2037.23	673.46	31.3365	166.1975
1708.00	689.94	505.16	664.23	674.11	674.06	2037.26	673.46	31.3365	166.1975
1709.00	690.25	505.17	664.23	674.11	674.06	2037.29	673.46	31.3365	166.1975
1710.00	690.56	505.18	664.23	674.11	674.06	2037.32	673.46	31.3365	166.1975
1711.00	690.87	505.19	664.23	674.11	674.06	2037.35	673.46	31.3365	166.1975
1712.00	691.18	505.20	664.23	674.11	674.06	2037.38	673.46	31.3365	166.1975
1713.00	691.49	505.21	664.23	674.11	674.06	2037.41	673.46	31.3365	166.1975
1714.00	691.80	505.22	664.23	674.11	674.06	2037.44	673.46	31.3365	166.1975
1715.00	692.11	505.23	664.23	674.11	674.06	2037.47	673.46	31.3365	166.1975
1716.00	692.42	505.24	664.23	674.11	674.06	2037.50	673.46	31.3365	166.1975
1717.00	692.73	505.25	664.23	674.11	674.06	2037.53	673.46	31.3365	166.1975
1718.00	693.04	505.26	664.23	674.11	674.06	2037.56	673.46	31.3365	166.1975
1719.00	693.35	505.27	664.23	674.11	674.06	2037.59	673.46	31.3365	166.1975
1720.00	693.66	505.28	664.23	674.11	674.06	2037.62	673.46	31.3365	166.1975
1721.00	693.97	505.29	664.23	674.11	674.06	2037.65	673.46	31.3365	166.1975
1722.00	694.28	505.30	664.23	674.11	674.06	2037.68	673.46	31.3365	166.1975
1723.00	694.59	505.31	664.23	674.11	674.06	2037.71	673.46	31.3365	166.1975
1724.00	694.90	505.32	664.23	674.11	674.06	2037.74	673.46	31.3365	166.1975
1725.00	695.21	505.33	664.23	674.11	674.06	2037.77	673.46	31.3365	166.1975
1726.00	695.52	505.34	664.23	674.11	674.06	2037.80	673.46	31.3365	166.1975
1727.00	695.83	505.35	664.23	674.11	674.06	2037.83	673.46	31.3365	166.1975
1728.00	696.14	505.36	664.23	674.11	674.06	2037.86	673.46	31.3365	166.1975
1729.00	696.45	505.37	664.23	674.11	674.06	2037.89	673.46	31.3365	166.1975
1730.00	696.76	505.38	664.23	674.11	674.06	2037.92	673.46	31.3365	166.1975
1731.00	697.07	505.39	664.23	674.11	674.06	2037.95	673.46	31.3365	166.1975
1732.00	697.38	505.40	664.23	674.11	674.06	2037.98	673.46	31.3365	166.1975
1733.00	697.69	505.41	664.23	674.11	674.06	2038.01	673.46	31.3365	166.1975
1734.00	698.00	505.42	664.23	674.11	674.06	2038.04	673.46	31.3365	166.1975
1735.00	698.31	505.43	664.23	674.11	674.06	2038.07	673.46	31.3365	166.1975
1736.00	698.62	505.44	664.23	674.11	674.06	2038.10	673.46	31.3365	166.1975
1737.00	698.93	505.45	664.23	674.11	674.06	2038.13	673.46	31.3365	166.1975

1738-00	697-92	44-97	60-3	11-26	63-7	57-87	704-12	2006-45	611-57	21-9440	166-7840
1739-00	696-06	44-98	58-20	11-27	63-8	57-88	705-0	2006-45	610-93	21-9526	166-7840
1740-00	696-20	44-99	58-21	11-28	63-9	57-89	705-1	2006-45	610-94	21-9527	166-7840
1741-00	696-33	44-86	58-22	11-29	63-10	57-90	706-0	2006-45	610-02	21-9604	166-7840
1742-00	696-46	44-78	58-23	11-30	63-11	57-91	707-06	2006-45	609-52	21-9605	166-7840
1743-00	696-58	44-73	58-24	11-31	63-12	57-92	708-12	1999-72	608-81	21-9606	166-7840
1744-00	696-71	44-58	58-25	11-32	63-13	57-93	710-60	1999-72	608-81	21-9607	166-7840
1745-00	696-84	44-51	58-26	11-33	63-14	57-94	711-14	1999-72	608-81	21-9608	166-7840
1746-00	696-94	44-45	58-27	11-34	63-15	57-95	712-18	1999-72	608-81	21-9609	166-7840
1747-00	697-06	44-37	58-28	11-35	63-16	57-96	713-18	1999-72	608-81	21-9610	166-7840
1748-00	697-16	44-36	58-29	11-36	63-17	57-97	714-01	1999-72	608-81	21-9611	166-7840
1749-00	697-27	44-23	58-30	11-37	63-18	57-98	715-11	1999-72	608-81	21-9612	166-7840
1750-00	697-53	44-19	58-31	11-38	63-19	57-99	716-11	1999-72	608-81	21-9613	166-7840
1751-00	697-53	44-06	58-32	11-39	63-20	57-00	717-11	1999-72	608-81	21-9614	166-7840
1752-00	697-62	43-98	58-33	11-40	63-21	57-01	718-11	1999-72	608-81	21-9615	166-7840
1753-00	697-71	43-88	58-34	11-41	63-22	57-02	719-11	1999-72	608-81	21-9616	166-7840
1754-00	697-80	43-78	58-35	11-42	63-23	57-03	720-11	1999-72	608-81	21-9617	166-7840
1755-00	697-89	43-78	58-36	11-43	63-24	57-04	721-11	1999-72	608-81	21-9618	166-7840
1756-00	697-96	43-74	58-37	11-44	63-25	57-05	722-11	1999-72	608-81	21-9619	166-7840
1757-00	698-04	43-71	58-38	11-45	63-26	57-06	723-11	1999-72	608-81	21-9620	166-7840
1758-00	698-11	43-67	58-39	11-46	63-27	57-07	724-11	1999-72	608-81	21-9621	166-7840
1759-00	698-18	43-55	58-40	11-47	63-28	57-08	725-11	1999-72	608-81	21-9622	166-7840
1760-00	698-25	43-50	58-41	11-48	63-29	57-09	726-11	1999-72	608-81	21-9623	166-7840
1761-00	698-31	43-43	58-42	11-49	63-30	57-10	727-11	1999-72	608-81	21-9624	166-7840
1762-00	698-37	43-34	58-43	11-50	63-31	57-11	728-11	1999-72	608-81	21-9625	166-7840
1763-00	698-43	43-24	58-44	11-51	63-32	57-12	729-11	1999-72	608-81	21-9626	166-7840
1764-00	698-48	43-24	58-45	11-52	63-33	57-13	730-11	1999-72	608-81	21-9627	166-7840
1765-00	698-53	43-20	58-46	11-53	63-34	57-14	731-11	1999-72	608-81	21-9628	166-7840
1766-00	698-58	43-14	58-47	11-54	63-35	57-15	732-11	1999-72	608-81	21-9629	166-7840
1767-00	698-63	43-03	58-48	11-55	63-36	57-16	733-11	1999-72	608-81	21-9630	166-7840
1768-00	698-67	42-93	58-49	11-56	63-37	57-17	734-11	1999-72	608-81	21-9631	166-7840
1769-00	698-71	42-86	58-50	11-57	63-38	57-18	735-11	1999-72	608-81	21-9632	166-7840
1770-00	698-74	42-84	58-51	11-58	63-39	57-19	736-11	1999-72	608-81	21-9633	166-7840
1771-00	698-77	42-84	58-52	11-59	63-40	57-20	737-11	1999-72	608-81	21-9634	166-7840
1772-00	698-80	42-77	58-53	11-60	63-41	57-21	738-11	1999-72	608-81	21-9635	166-7840
1773-00	698-83	42-68	58-54	11-61	63-42	57-22	739-11	1999-72	608-81	21-9636	166-7840
1774-00	698-86	42-61	58-55	11-62	63-43	57-23	740-11	1999-72	608-81	21-9637	166-7840
1775-00	698-88	42-54	58-56	11-63	63-44	57-24	741-11	1999-72	608-81	21-9638	166-7840
1776-00	698-90	42-44	58-57	11-64	63-45	57-25	742-11	1999-72	608-81	21-9639	166-7840
1777-00	698-91	42-40	58-58	11-65	63-46	57-26	743-11	1999-72	608-81	21-9640	166-7840
1778-00	698-93	42-37	58-59	11-66	63-47	57-27	744-11	1999-72	608-81	21-9641	166-7840
1779-00	698-94	42-31	58-60	11-67	63-48	57-28	745-11	1999-72	608-81	21-9642	166-7840
1780-00	698-93	42-21	58-61	11-68	63-49	57-29	746-11	1999-72	608-81	21-9643	166-7840
1781-00	698-93	42-15	58-62	11-69	63-50	57-30	747-11	1999-72	608-81	21-9644	166-7840
1782-00	698-94	42-11	58-63	11-70	63-51	57-31	748-11	1999-72	608-81	21-9645	166-7840
1783-00	698-95	42-06	58-64	11-71	63-52	57-32	749-11	1999-72	608-81	21-9646	166-7840
1784-00	698-95	42-02	58-65	11-72	63-53	57-33	750-11	1999-72	608-81	21-9647	166-7840
1785-00	698-95	41-94	58-66	11-73	63-54	57-34	751-11	1999-72	608-81	21-9648	166-7840
1786-00	698-94	41-84	58-67	11-74	63-55	57-35	752-11	1999-72	608-81	21-9649	166-7840
1787-00	698-93	41-87	58-68	11-75	63-56	57-36	753-11	1999-72	608-81	21-9650	166-7840
1788-00	698-90	41-84	58-69	11-76	63-57	57-37	754-11	1999-72	608-81	21-9651	166-7840

Probe No. 6; 11ft-off time: H+1860 seconds; and project No. 6.13

Raw data referenced to the ship		Quantities have been translated to the launcher position									
Time, sec	Range, km	Azimuth, deg T	Elevation, deg Geod.	x, km distance east	y, km distance north	z at launcher	$\sqrt{x^2 + y^2}$, km	Height above earth, kft	Height above earth, km	Latitude of target, deg	Longitude of target, deg

1951.00	410.25	187.95	17.57	32.73	127.97	102.96	618.77	127.66	162.6697
1952.00	411.05	187.93	16.77	33.23	129.09	112.46	623.46	129.07	162.6658
1953.00	411.84	187.90	16.03	33.74	130.29	113.08	628.35	130.56	162.6629
1954.00	412.63	187.89	15.29	34.24	131.57	113.76	633.55	132.23	162.6601
1955.00	413.42	187.86	14.56	34.74	132.91	114.51	639.08	134.04	162.6574
1956.00	414.22	187.81	13.84	35.24	134.20	115.33	644.94	136.00	162.6548
1957.00	415.01	187.74	13.13	35.74	135.54	116.21	651.15	138.14	162.6523
1958.00	415.80	187.71	12.43	36.24	136.87	117.15	657.71	140.46	162.6499
1959.00	416.59	187.71	11.75	36.74	138.31	118.15	664.63	142.97	162.6476
1960.00	417.38	187.74	11.09	37.24	139.77	119.21	671.91	145.67	162.6454
1961.00	418.18	187.71	10.45	37.74	141.25	120.34	679.56	148.57	162.6433
1962.00	418.96	187.70	9.83	38.24	142.76	121.53	687.58	151.67	162.6413
1963.00	419.75	187.68	9.23	38.74	144.29	122.78	695.97	154.97	162.6394
1964.00	420.54	187.64	8.65	39.24	145.84	124.09	704.73	158.47	162.6376
1965.00	421.32	187.64	8.09	39.74	147.41	125.46	713.86	162.17	162.6359
1966.00	422.11	187.62	7.55	40.24	148.99	126.90	723.36	166.07	162.6343
1967.00	422.89	187.59	7.03	40.74	150.59	128.40	733.24	170.17	162.6328
1968.00	423.67	187.53	6.53	41.24	152.21	129.96	743.50	174.57	162.6314
1969.00	424.45	187.58	6.05	41.74	153.84	131.58	754.14	179.27	162.6301
1970.00	425.24	187.57	5.59	42.24	155.49	133.27	765.16	184.27	162.6289
1971.00	426.01	187.55	5.15	42.74	157.16	135.07	776.56	189.57	162.6278
1972.00	426.79	187.53	4.73	43.24	158.84	136.89	788.34	195.17	162.6268
1973.00	427.56	187.48	4.33	43.74	160.54	138.74	800.50	201.07	162.6259
1974.00	428.33	187.46	3.95	44.24	162.25	140.61	813.04	207.27	162.6251
1975.00	429.11	187.45	3.59	44.74	163.97	142.51	825.96	213.77	162.6244
1976.00	429.87	187.43	3.25	45.24	165.76	144.44	839.26	220.57	162.6238
1977.00	430.64	187.41	2.93	45.74	167.57	146.40	852.94	227.67	162.6233
1978.00	431.40	187.40	2.63	46.24	169.41	148.39	867.00	235.07	162.6229
1979.00	432.15	187.36	2.35	46.74	171.27	150.41	881.44	242.77	162.6226
1980.00	432.93	187.35	2.08	47.24	173.16	152.46	896.26	250.77	162.6224
1981.00	433.69	187.34	1.83	47.74	175.07	154.54	911.46	259.07	162.6222
1982.00	434.45	187.33	1.59	48.24	177.00	156.65	927.04	267.67	162.6221
1983.00	435.20	187.31	1.36	48.74	178.95	158.79	942.99	276.57	162.6220
1984.00	435.95	187.29	1.15	49.24	180.92	160.96	959.31	285.77	162.6219
1985.00	436.70	187.27	0.95	49.74	182.91	163.16	975.99	295.27	162.6218
1986.00	437.45	187.26	0.77	50.24	184.92	165.39	993.04	305.07	162.6217
1987.00	438.20	187.24	0.60	50.74	186.95	167.64	1010.46	315.17	162.6216
1988.00	438.94	187.23	0.45	51.24	189.00	169.91	1028.24	325.57	162.6215
1989.00	439.68	187.18	0.31	51.74	191.07	172.20	1046.38	336.27	162.6214
1990.00	440.42	187.16	0.18	52.24	193.16	174.51	1064.78	347.27	162.6213
1991.00	441.16	187.13	0.06	52.74	195.27	176.84	1083.44	358.57	162.6212
1992.00	441.89	187.12	0.00	53.24	197.40	179.19	1102.36	370.17	162.6211
1993.00	442.61	187.11	0.00	53.74	199.55	181.66	1121.54	382.07	162.6210
1994.00	443.34	187.11	0.00	54.24	201.72	184.16	1140.98	394.27	162.6209
1995.00	444.07	187.10	0.00	54.74	203.91	186.68	1160.68	406.77	162.6208
1996.00	444.79	187.09	0.00	55.24	206.12	189.23	1180.64	419.57	162.6207
1997.00	445.51	187.06	0.00	55.74	208.35	191.80	1200.86	432.67	162.6206
1998.00	446.22	187.03	0.00	56.24	210.60	194.39	1221.34	446.07	162.6205
1999.00	446.94	187.00	0.00	56.74	212.87	197.00	1242.08	459.77	162.6204
2000.00	447.64	186.97	0.00	57.24	215.16	199.63	1263.08	473.77	162.6203
2001.00	448.35	186.95	0.00	57.74	217.46	202.29	1284.34	488.07	162.6202

2002.00	449.05	186.96	22.17	10.96	-50.27	182.50	51.60	599.40	182.70	16.7968	-169.4259
2003.00	449.75	186.95	22.75	10.99	-50.55	182.43	51.73	602.47	183.63	16.7968	-169.4256
2004.00	450.45	186.97	23.40	11.03	-50.86	182.02	52.25	607.47	184.73	16.7895	-169.4246
2005.00	451.14	186.90	24.10	11.06	-51.15	181.04	52.57	614.79	185.26	16.7809	-169.4233
2006.00	451.83	186.88	24.66	11.13	-51.76	180.81	52.97	619.12	186.03	16.7835	-169.4225
2007.00	452.52	186.87	25.55	11.19	-52.07	180.74	53.32	613.39	186.96	16.7807	-169.4220
2008.00	453.21	186.84	26.60	11.22	-52.68	181.54	53.73	618.02	187.76	16.7774	-169.4208
2009.00	453.85	186.84	27.70	11.27	-53.12	182.33	54.05	613.67	188.54	16.7745	-169.4211
2010.00	454.57	186.87	28.76	11.31	-53.25	182.09	54.31	611.17	189.37	16.7707	-169.4200
2011.00	455.24	186.78	29.83	11.37	-53.65	182.87	54.93	613.70	190.10	16.7673	-169.4181
2012.00	455.91	186.75	30.85	11.41	-54.10	190.34	55.41	615.74	190.57	16.7626	-169.4164
2013.00	456.58	186.76	31.93	11.46	-54.51	191.19	55.80	614.04	191.43	16.7599	-169.4173
2014.00	457.24	186.75	32.96	11.53	-54.90	191.71	56.28	619.76	191.95	16.7556	-169.4172
2015.00	457.90	186.70	34.07	11.59	-55.26	192.79	56.59	613.33	193.04	16.7536	-169.4139
2016.00	458.55	186.70	35.11	11.63	-55.67	193.40	56.99	615.13	193.65	16.7499	-169.4145
2017.00	459.21	186.68	36.18	11.70	-56.05	194.12	57.18	617.12	194.38	16.7467	-169.4139
2018.00	459.85	186.68	37.26	11.79	-56.41	195.29	57.63	610.75	195.30	16.7444	-169.4141
2019.00	460.50	186.64	38.35	11.84	-56.71	196.27	58.20	611.55	195.55	16.7392	-169.4149
2020.00	461.14	186.64	39.45	11.88	-57.16	196.80	58.41	614.51	196.54	16.7371	-169.4151
2021.00	462.41	186.62	40.59	11.94	-57.63	197.80	58.98	614.86	197.07	16.7330	-169.4123
2022.00	463.08	186.60	41.74	11.97	-58.02	198.72	59.38	618.68	197.72	16.7297	-169.4110
2023.00	463.68	186.58	42.90	12.04	-58.40	199.12	59.76	620.87	198.39	16.7264	-169.4106
2024.00	464.29	186.56	44.13	12.08	-58.71	199.32	60.09	615.57	199.19	16.7237	-169.4095
2025.00	464.91	186.54	45.43	12.14	-59.18	199.94	60.56	615.97	200.23	16.7160	-169.4082
2026.00	465.53	186.54	46.68	12.21	-59.60	199.19	60.99	615.97	200.90	16.7128	-169.4069
2027.00	466.15	186.52	47.98	12.26	-59.94	200.61	61.39	615.11	201.57	16.7099	-169.4075
2028.00	466.75	186.52	49.30	12.31	-60.32	201.28	61.71	611.32	202.21	16.7067	-169.4064
2029.00	467.35	186.49	50.64	12.34	-60.69	202.46	62.50	615.21	202.76	16.7032	-169.4061
2030.00	467.95	186.47	52.00	12.36	-61.10	203.03	62.70	615.21	203.33	16.7098	-169.4054
2031.00	468.55	186.45	53.37	12.37	-61.49	203.81	63.20	617.68	204.12	16.7074	-169.4044
2032.00	469.14	186.47	54.77	12.37	-61.77	204.30	63.67	613.29	204.61	16.7036	-169.4027
2033.00	469.73	186.43	56.19	12.35	-62.21	204.86	64.09	613.13	205.17	16.7002	-169.4012
2034.00	470.36	186.39	57.61	12.32	-62.61	205.86	64.52	614.81	205.68	16.6964	-169.4014
2035.00	470.90	186.37	59.05	12.30	-63.05	205.88	64.86	616.52	206.20	16.6934	-169.4012
2036.00	471.47	186.37	60.51	12.33	-63.49	206.39	65.26	618.20	206.72	16.6900	-169.4005
2037.00	472.04	186.36	61.93	12.30	-63.79	206.84	65.67	619.70	207.17	16.6864	-169.4005
2038.00	472.61	186.35	63.36	12.30	-64.20	207.30	66.08	618.21	207.63	16.6834	-169.4000
2039.00	473.18	186.34	64.81	12.38	-64.61	207.65	66.53	618.21	207.99	16.6799	-169.3999
2040.00	473.74	186.30	66.27	12.38	-65.07	208.27	66.92	618.44	208.62	16.6769	-169.3973
2041.00	474.29	186.27	67.76	12.40	-65.41	208.85	67.29	618.36	209.20	16.6736	-169.3960
2042.00	474.84	186.25	69.26	12.42	-65.75	209.37	67.67	618.06	209.72	16.6700	-169.3950
2043.00	475.39	186.24	70.77	12.40	-66.12	209.84	68.06	618.61	210.19	16.6666	-169.3943
2044.00	475.93	186.24	72.29	12.37	-66.46	210.32	68.41	618.20	210.66	16.6635	-169.3946
2045.00	476.47	186.23	73.83	12.35	-66.86	210.75	68.79	618.62	211.11	16.6602	-169.3946
2046.00	477.01	186.21	75.38	12.32	-67.25	211.12	69.22	618.05	211.49	16.6568	-169.3938
2047.00	477.54	186.21	76.93	12.26	-67.67	211.50	69.55	618.44	211.96	16.6535	-169.3942
2048.00	478.07	186.18	78.47	12.21	-68.14	212.08	69.95	617.04	212.46	16.6504	-169.3923
2049.00	478.59	186.15	79.99	12.14	-68.59	212.54	70.35	618.54	212.92	16.6472	-169.3907
2050.00	479.11	186.15	81.51	12.07	-69.12	212.61	70.95	618.80	213.22	16.6432	-169.3888
2051.00	479.62	186.09	83.02	12.01	-69.61	213.23	71.26	700.86	213.67	16.6399	-169.3871

2053.00	186.07	73.13	213.30	71.76	701.10	213.70	16.1253	169.1080
2054.00	186.08	70.54	213.03	72.06	702.84	218.23	16.1271	169.1076
2055.00	186.07	70.58	214.33	72.36	704.20	218.73	16.1290	169.1071
2056.00	186.15	70.77	215.65	72.06	706.03	216.05	16.1110	169.1095
2057.00	186.09	71.44	215.10	73.07	708.03	215.51	16.1160	169.1089
2058.00	186.06	71.33	215.42	73.45	710.11	215.83	16.1106	169.1070
2059.00	186.05	72.33	215.90	73.91	710.91	216.22	16.1172	169.1089
2060.00	186.03	73.36	216.11	74.28	710.68	216.62	16.1141	169.1075
2061.00	186.00	73.36	216.69	74.99	710.07	216.13	16.0973	169.1067
2062.00	185.94	73.36	216.56	75.33	711.90	216.99	16.0962	169.1061
2063.00	185.94	73.36	216.70	75.66	712.38	217.14	16.0924	169.1013
2064.00	185.96	74.13	216.13	76.02	713.16	217.37	16.0889	169.1017
2065.00	185.96	74.13	217.12	76.38	713.81	217.57	16.0854	169.1032
2066.00	185.91	75.33	217.60	76.74	715.57	218.05	16.0829	169.1070
2067.00	185.87	75.33	217.98	77.15	716.32	218.33	16.0776	169.1085
2068.00	185.87	75.76	218.19	77.50	717.34	218.65	16.0766	169.1179
2069.00	185.93	76.16	218.29	77.79	717.69	218.75	16.0731	169.1077
2070.00	185.86	76.55	218.77	78.19	719.28	219.24	16.0706	169.1075
2071.00	185.81	76.55	219.08	78.70	719.70	219.36	16.0666	169.1068
2072.00	185.81	76.91	219.89	79.08	719.70	219.55	16.0632	169.1068
2073.00	185.77	77.30	219.08	79.59	720.59	219.55	16.0592	169.1076
2074.00	185.76	77.71	218.15	79.90	721.66	219.76	16.0565	169.1072
2075.00	185.77	78.07	218.47	80.14	722.84	220.32	16.0542	169.1072
2076.00	185.77	78.16	219.85	80.58	722.84	220.32	16.0502	169.1072
2077.00	185.76	78.50	219.85	81.00	723.13	220.41	16.0464	169.1072
2078.00	185.73	79.23	219.91	81.42	723.83	220.62	16.0432	169.1072
2079.00	185.73	79.23	220.12	81.80	724.49	220.83	16.0401	169.1069
2080.00	185.70	79.97	220.31	82.11	724.46	220.81	16.0359	169.1080
2081.00	185.67	80.46	220.31	82.74	725.42	220.81	16.0321	169.1082
2082.00	185.65	80.30	220.30	83.06	726.10	221.11	16.0295	169.1072
2083.00	185.65	81.13	220.79	83.32	726.10	221.32	16.0268	169.1080
2084.00	185.67	81.63	221.08	83.64	726.99	221.59	16.0263	169.1076
2085.00	185.62	82.25	221.02	84.11	726.89	221.56	16.0203	169.1063
2086.00	185.61	82.75	220.99	84.55	726.81	221.53	16.0164	169.1060
2087.00	185.59	83.31	220.99	85.26	727.20	221.04	16.0103	169.1069
2088.00	185.56	83.50	220.69	85.39	727.02	221.60	16.0093	169.1062
2089.00	185.56	83.71	221.22	85.71	727.61	221.78	16.0066	169.1035
2090.00	185.53	84.29	221.27	86.14	727.83	221.84	16.0032	169.1013
2091.00	185.51	84.71	221.29	86.07	727.24	221.66	15.9987	169.1001
2092.00	185.51	85.25	221.09	86.99	727.52	221.75	15.9958	169.1007
2093.00	185.52	85.67	221.17	87.37	727.55	221.76	15.9926	169.1018
2094.00	185.50	86.24	221.17	87.76	727.35	221.70	15.9889	169.1009
2095.00	185.50	86.71	221.12	88.12	727.40	221.71	15.9856	169.1009
2096.00	185.47	87.23	221.16	88.53	727.40	221.73	15.9823	169.1003
2097.00	185.44	87.71	221.07	88.97	727.26	221.67	15.9787	169.1077
2098.00	185.46	88.05	221.62	88.99	727.08	222.23	15.9783	169.1052
2099.00	185.40	87.37	221.05	89.76	727.24	221.66	15.9721	169.1053
2100.00	185.41	88.11	221.02	90.09	727.16	221.64	15.9690	169.1061
2101.00	185.40	88.50	220.94	90.47	726.91	221.56	15.9656	169.1061
2102.00	185.39	89.00	220.94	91.85	726.82	218.72	15.9473	169.1061
2103.00	185.67	90.47	218.01	91.97	717.36	218.65	15.9479	169.1069

Table with 10 columns of numerical data. The values range from approximately 100 to 240 across the columns. The data appears to be organized in rows corresponding to sequential entries or items.

0 0
100.00
16.7300 -169.5255
19.9279 -168.7670
19.9275 -168.7697
0
240.00
3.0000
40.7000
1992649.00
198100.00
0.00
1.00
2095568.50
214000.30

Probe No. 7; lift-off time: H+2400 seconds; and project No. 6.2

Raw data referenced to the ship		Quantities have been translated to the launcher position									
Time, sec	Range, km	Azimuth, deg T	Elevation, deg Geod.	x , km distance east	y , km distance north	z at launcher	$\sqrt{x^2 + y^2}$, km	Height above earth, kft	Height above earth, km	Latitude of target, deg	Longitude of target, deg

665.11	5.74.75	176.67	7.4.7	177.11	665.11	193.66	1508.03	668.79	182.179	168.0.0.0
666.11	5.74.75	176.67	7.4.7	177.11	666.11	193.66	1508.03	669.79	182.179	168.0.0.0
667.11	5.74.75	176.67	7.4.7	177.11	667.11	193.66	1508.03	670.79	182.179	168.0.0.0
668.11	5.74.75	176.67	7.4.7	177.11	668.11	193.66	1508.03	671.79	182.179	168.0.0.0
669.11	5.74.75	176.67	7.4.7	177.11	669.11	193.66	1508.03	672.79	182.179	168.0.0.0
670.11	5.74.75	176.67	7.4.7	177.11	670.11	193.66	1508.03	673.79	182.179	168.0.0.0
671.11	5.74.75	176.67	7.4.7	177.11	671.11	193.66	1508.03	674.79	182.179	168.0.0.0
672.11	5.74.75	176.67	7.4.7	177.11	672.11	193.66	1508.03	675.79	182.179	168.0.0.0
673.11	5.74.75	176.67	7.4.7	177.11	673.11	193.66	1508.03	676.79	182.179	168.0.0.0
674.11	5.74.75	176.67	7.4.7	177.11	674.11	193.66	1508.03	677.79	182.179	168.0.0.0
675.11	5.74.75	176.67	7.4.7	177.11	675.11	193.66	1508.03	678.79	182.179	168.0.0.0
676.11	5.74.75	176.67	7.4.7	177.11	676.11	193.66	1508.03	679.79	182.179	168.0.0.0
677.11	5.74.75	176.67	7.4.7	177.11	677.11	193.66	1508.03	680.79	182.179	168.0.0.0
678.11	5.74.75	176.67	7.4.7	177.11	678.11	193.66	1508.03	681.79	182.179	168.0.0.0
679.11	5.74.75	176.67	7.4.7	177.11	679.11	193.66	1508.03	682.79	182.179	168.0.0.0
680.11	5.74.75	176.67	7.4.7	177.11	680.11	193.66	1508.03	683.79	182.179	168.0.0.0
681.11	5.74.75	176.67	7.4.7	177.11	681.11	193.66	1508.03	684.79	182.179	168.0.0.0
682.11	5.74.75	176.67	7.4.7	177.11	682.11	193.66	1508.03	685.79	182.179	168.0.0.0
683.11	5.74.75	176.67	7.4.7	177.11	683.11	193.66	1508.03	686.79	182.179	168.0.0.0
684.11	5.74.75	176.67	7.4.7	177.11	684.11	193.66	1508.03	687.79	182.179	168.0.0.0
685.11	5.74.75	176.67	7.4.7	177.11	685.11	193.66	1508.03	688.79	182.179	168.0.0.0
686.11	5.74.75	176.67	7.4.7	177.11	686.11	193.66	1508.03	689.79	182.179	168.0.0.0
687.11	5.74.75	176.67	7.4.7	177.11	687.11	193.66	1508.03	690.79	182.179	168.0.0.0
688.11	5.74.75	176.67	7.4.7	177.11	688.11	193.66	1508.03	691.79	182.179	168.0.0.0
689.11	5.74.75	176.67	7.4.7	177.11	689.11	193.66	1508.03	692.79	182.179	168.0.0.0
690.11	5.74.75	176.67	7.4.7	177.11	690.11	193.66	1508.03	693.79	182.179	168.0.0.0
691.11	5.74.75	176.67	7.4.7	177.11	691.11	193.66	1508.03	694.79	182.179	168.0.0.0
692.11	5.74.75	176.67	7.4.7	177.11	692.11	193.66	1508.03	695.79	182.179	168.0.0.0
693.11	5.74.75	176.67	7.4.7	177.11	693.11	193.66	1508.03	696.79	182.179	168.0.0.0
694.11	5.74.75	176.67	7.4.7	177.11	694.11	193.66	1508.03	697.79	182.179	168.0.0.0
695.11	5.74.75	176.67	7.4.7	177.11	695.11	193.66	1508.03	698.79	182.179	168.0.0.0
696.11	5.74.75	176.67	7.4.7	177.11	696.11	193.66	1508.03	699.79	182.179	168.0.0.0
697.11	5.74.75	176.67	7.4.7	177.11	697.11	193.66	1508.03	700.79	182.179	168.0.0.0
698.11	5.74.75	176.67	7.4.7	177.11	698.11	193.66	1508.03	701.79	182.179	168.0.0.0
699.11	5.74.75	176.67	7.4.7	177.11	699.11	193.66	1508.03	702.79	182.179	168.0.0.0
700.11	5.74.75	176.67	7.4.7	177.11	700.11	193.66	1508.03	703.79	182.179	168.0.0.0

2812-00	691-94	75-74	17-65	613-13	663-77	603-37	2762-09	693-39	70-1619	1626-177
2893-00	691-93	75-67	17-66	613-12	663-76	603-36	2761-08	693-38	70-1618	1626-176
2914-00	691-91	75-78	17-66	613-16	663-66	603-34	2761-08	693-36	70-1618	1626-176
2815-00	691-89	75-17	17-60	613-11	663-79	603-39	2761-07	693-35	70-1617	1626-175
2896-00	691-86	75-09	17-58	613-16	663-76	603-38	2761-06	693-34	70-1616	1626-174
2892-00	691-82	74-17	17-66	613-21	663-82	603-42	2761-05	693-30	70-1615	1626-173
2898-00	691-78	74-60	17-66	613-21	663-82	603-42	2761-04	693-29	70-1614	1626-172
2899-00	691-73	74-29	17-60	613-15	663-75	603-36	2761-03	693-28	70-1613	1626-171
2900-00	691-68	73-33	17-69	613-13	663-73	603-33	2761-02	693-27	70-1612	1626-170
2901-00	691-61	72-18	17-65	613-17	663-77	603-37	2761-01	693-26	70-1611	1626-169
2902-00	691-54	72-18	17-65	613-17	663-77	603-37	2761-00	693-25	70-1610	1626-168
2903-00	691-47	72-05	17-61	613-13	663-73	603-33	2760-99	693-24	70-1609	1626-167
2904-00	691-39	71-59	17-60	613-12	663-72	603-32	2760-98	693-23	70-1608	1626-166
2905-00	691-30	71-07	17-59	613-11	663-71	603-31	2760-97	693-22	70-1607	1626-165
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2907-00	691-11	70-09	17-63	613-16	663-76	603-36	2760-95	693-20	70-1605	1626-163
2908-00	691-00	69-36	17-63	613-16	663-76	603-36	2760-94	693-19	70-1604	1626-162
2909-00	690-89	69-36	17-63	613-16	663-76	603-36	2760-93	693-18	70-1603	1626-161
2910-00	690-77	69-36	17-63	613-16	663-76	603-36	2760-92	693-17	70-1602	1626-160
2911-00	690-65	69-10	17-63	613-13	663-73	603-33	2760-91	693-16	70-1601	1626-159
2912-00	690-52	68-79	17-63	613-13	663-73	603-33	2760-90	693-15	70-1600	1626-158
2913-00	690-38	68-57	17-60	613-16	663-76	603-36	2760-89	693-14	70-1599	1626-157
2914-00	690-23	68-09	17-56	613-16	663-76	603-36	2760-88	693-13	70-1598	1626-156
2915-00	690-09	67-34	17-59	613-16	663-76	603-36	2760-87	693-12	70-1597	1626-155
2916-00	689-93	67-05	17-59	613-13	663-73	603-33	2760-86	693-11	70-1596	1626-154
2917-00	689-76	67-26	17-57	613-17	663-77	603-37	2760-85	693-10	70-1595	1626-153
2918-00	689-60	67-26	17-57	613-17	663-77	603-37	2760-84	693-09	70-1594	1626-152
2919-00	689-42	66-86	17-57	613-16	663-76	603-36	2760-83	693-08	70-1593	1626-151
2920-00	689-24	66-62	17-57	613-16	663-76	603-36	2760-82	693-07	70-1592	1626-150
2921-00	689-05	66-06	17-56	613-16	663-76	603-36	2760-81	693-06	70-1591	1626-149
2922-00	688-86	65-17	17-59	613-16	663-76	603-36	2760-80	693-05	70-1590	1626-148
2923-00	688-66	65-34	17-59	613-16	663-76	603-36	2760-79	693-04	70-1589	1626-147
2924-00	688-46	64-74	17-54	613-16	663-76	603-36	2760-78	693-03	70-1588	1626-146
2925-00	688-26	64-26	17-54	613-16	663-76	603-36	2760-77	693-02	70-1587	1626-145
2926-00	688-06	64-36	17-53	613-11	663-71	603-31	2760-76	693-01	70-1586	1626-144
2927-00	687-80	64-27	17-51	613-11	663-71	603-31	2760-75	693-00	70-1585	1626-143
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2929-00	687-33	64-23	17-51	613-11	663-71	603-31	2760-73	692-98	70-1583	1626-141
2930-00	687-08	63-60	17-51	613-11	663-71	603-31	2760-72	692-97	70-1582	1626-140
2931-00	686-88	63-13	17-51	613-11	663-71	603-31	2760-71	692-96	70-1581	1626-139
2932-00	686-53	62-13	17-51	613-11	663-71	603-31	2760-70	692-95	70-1580	1626-138
2933-00	686-37	62-48	17-36	613-16	663-76	603-36	2760-69	692-94	70-1579	1626-137
2934-00	686-06	62-27	17-60	613-16	663-76	603-36	2760-68	692-93	70-1578	1626-136
2935-00	685-78	61-94	17-31	613-16	663-76	603-36	2760-67	692-92	70-1577	1626-135
2936-00	685-50	61-42	17-33	613-16	663-76	603-36	2760-66	692-91	70-1576	1626-134
2937-00	685-22	61-25	17-36	613-16	663-76	603-36	2760-65	692-90	70-1575	1626-133
2938-00	684-92	61-16	17-36	613-16	663-76	603-36	2760-64	692-89	70-1574	1626-132
2939-00	684-64	61-36	17-36	613-16	663-76	603-36	2760-63	692-88	70-1573	1626-131
2940-00	684-37	61-02	17-59	613-16	663-76	603-36	2760-62	692-87	70-1572	1626-130
2941-00	684-01	60-53	17-59	613-16	663-76	603-36	2760-61	692-86	70-1571	1626-129
2942-00	683-69	60-03	17-51	613-16	663-76	603-36	2760-60	692-85	70-1570	1626-128

2943.00	683.37	592.84	772.37	191.10	562.27	503.50	2112.72	1672.8674
2944.00	683.04	592.97	772.75	191.25	662.71	503.82	2191.04	1672.8675
2945.00	682.71	593.09	773.13	191.40	662.37	504.08	2190.83	1672.8676
2946.00	682.37	592.56	772.46	191.56	662.04	503.31	2190.04	1672.8677
2947.00	682.02	592.21	771.76	191.71	661.70	502.54	2189.26	1672.8678
2948.00	681.67	591.87	771.07	191.86	661.36	501.77	2188.48	1672.8679
2949.00	681.31	591.52	770.37	192.01	661.02	501.00	2187.70	1672.8680
2950.00	680.95	591.17	769.67	192.16	660.68	500.23	2186.92	1672.8681
2951.00	680.59	590.82	768.97	192.31	660.34	499.46	2186.14	1672.8682
2952.00	680.23	590.47	768.27	192.46	660.00	498.69	2185.36	1672.8683
2953.00	679.87	590.12	767.57	192.61	659.66	497.92	2184.58	1672.8684
2954.00	679.51	589.77	766.87	192.76	659.32	497.15	2183.80	1672.8685
2955.00	679.15	589.42	766.17	192.91	658.98	496.38	2183.02	1672.8686
2956.00	678.79	589.07	765.47	193.06	658.64	495.61	2182.24	1672.8687
2957.00	678.43	588.72	764.77	193.21	658.30	494.84	2181.46	1672.8688
2958.00	678.07	588.37	764.07	193.36	657.96	494.07	2180.68	1672.8689
2959.00	677.71	588.02	763.37	193.51	657.62	493.30	2179.90	1672.8690
2960.00	677.35	587.67	762.67	193.66	657.28	492.53	2179.12	1672.8691
2961.00	676.99	587.32	761.97	193.81	656.94	491.76	2178.34	1672.8692
2962.00	676.63	586.97	761.27	193.96	656.60	490.99	2177.56	1672.8693
2963.00	676.27	586.62	760.57	194.11	656.26	490.22	2176.78	1672.8694
2964.00	675.91	586.27	759.87	194.26	655.92	489.45	2176.00	1672.8695
2965.00	675.55	585.92	759.17	194.41	655.58	488.68	2175.22	1672.8696
2966.00	675.19	585.57	758.47	194.56	655.24	487.91	2174.44	1672.8697
2967.00	674.83	585.22	757.77	194.71	654.90	487.14	2173.66	1672.8698
2968.00	674.47	584.87	757.07	194.86	654.56	486.37	2172.88	1672.8699
2969.00	674.11	584.52	756.37	195.01	654.22	485.60	2172.10	1672.8700
2970.00	673.75	584.17	755.67	195.16	653.88	484.83	2171.32	1672.8701
2971.00	673.39	583.82	754.97	195.31	653.54	484.06	2170.54	1672.8702
2972.00	673.03	583.47	754.27	195.46	653.20	483.29	2169.76	1672.8703
2973.00	672.67	583.12	753.57	195.61	652.86	482.52	2168.98	1672.8704
2974.00	672.31	582.77	752.87	195.76	652.52	481.75	2168.20	1672.8705
2975.00	671.95	582.42	752.17	195.91	652.18	480.98	2167.42	1672.8706
2976.00	671.59	582.07	751.47	196.06	651.84	480.21	2166.64	1672.8707
2977.00	671.23	581.72	750.77	196.21	651.50	479.44	2165.86	1672.8708
2978.00	670.87	581.37	750.07	196.36	651.16	478.67	2165.08	1672.8709
2979.00	670.51	581.02	749.37	196.51	650.82	477.90	2164.30	1672.8710
2980.00	670.15	580.67	748.67	196.66	650.48	477.13	2163.52	1672.8711
2981.00	669.79	580.32	747.97	196.81	650.14	476.36	2162.74	1672.8712
2982.00	669.43	579.97	747.27	196.96	649.80	475.59	2161.96	1672.8713
2983.00	669.07	579.62	746.57	197.11	649.46	474.82	2161.18	1672.8714
2984.00	668.71	579.27	745.87	197.26	649.12	474.05	2160.40	1672.8715
2985.00	668.35	578.92	745.17	197.41	648.78	473.28	2159.62	1672.8716
2986.00	667.99	578.57	744.47	197.56	648.44	472.51	2158.84	1672.8717
2987.00	667.63	578.22	743.77	197.71	648.10	471.74	2158.06	1672.8718
2988.00	667.27	577.87	743.07	197.86	647.76	470.97	2157.28	1672.8719
2989.00	666.91	577.52	742.37	198.01	647.42	470.20	2156.50	1672.8720
2990.00	666.55	577.17	741.67	198.16	647.08	469.43	2155.72	1672.8721
2991.00	666.19	576.82	740.97	198.31	646.74	468.66	2154.94	1672.8722
2992.00	665.83	576.47	740.27	198.46	646.40	467.89	2154.16	1672.8723
2993.00	665.47	576.12	739.57	198.61	646.06	467.12	2153.38	1672.8724
2994.00	665.11	575.77	738.87	198.76	645.72	466.35	2152.60	1672.8725
2995.00	664.75	575.42	738.17	198.91	645.38	465.58	2151.82	1672.8726
2996.00	664.39	575.07	737.47	199.06	645.04	464.81	2151.04	1672.8727
2997.00	664.03	574.72	736.77	199.21	644.70	464.04	2150.26	1672.8728
2998.00	663.67	574.37	736.07	199.36	644.36	463.27	2149.48	1672.8729
2999.00	663.31	574.02	735.37	199.51	644.02	462.50	2148.70	1672.8730
3000.00	662.95	573.67	734.67	199.66	643.68	461.73	2147.92	1672.8731

1161-01	51-57	60-22	70-17	75-16	80-13	85-12	90-13	95-11	100-13	105-10	110-11	115-11	120-11	125-11	130-11	135-11	140-11	145-11	150-11	155-11	160-11	165-11	170-11	175-11	180-11	185-11	190-11	195-11	200-11	205-11	210-11	215-11	220-11	225-11	230-11	235-11	240-11	245-11	250-11	255-11	260-11	265-11	270-11	275-11	280-11	285-11	290-11	295-11	300-11	305-11	310-11	315-11	320-11	325-11	330-11	335-11	340-11	345-11	350-11	355-11	360-11	365-11	370-11	375-11	380-11	385-11	390-11	395-11	400-11	405-11	410-11	415-11	420-11	425-11	430-11	435-11	440-11	445-11	450-11	455-11	460-11	465-11	470-11	475-11	480-11	485-11	490-11	495-11	500-11	505-11	510-11	515-11	520-11	525-11	530-11	535-11	540-11	545-11	550-11	555-11	560-11	565-11	570-11	575-11	580-11	585-11	590-11	595-11	600-11	605-11	610-11	615-11	620-11	625-11	630-11	635-11	640-11	645-11	650-11	655-11	660-11	665-11	670-11	675-11	680-11	685-11	690-11	695-11	700-11	705-11	710-11	715-11	720-11	725-11	730-11	735-11	740-11	745-11	750-11	755-11	760-11	765-11	770-11	775-11	780-11	785-11	790-11	795-11	800-11	805-11	810-11	815-11	820-11	825-11	830-11	835-11	840-11	845-11	850-11	855-11	860-11	865-11	870-11	875-11	880-11	885-11	890-11	895-11	900-11	905-11	910-11	915-11	920-11	925-11	930-11	935-11	940-11	945-11	950-11	955-11	960-11	965-11	970-11	975-11	980-11	985-11	990-11	995-11	1000-11
167-0077	167-0078	167-0079	167-0080	167-0081	167-0082	167-0083	167-0084	167-0085	167-0086	167-0087	167-0088	167-0089	167-0090	167-0091	167-0092	167-0093	167-0094	167-0095	167-0096	167-0097	167-0098	167-0099	167-0100	167-0101	167-0102	167-0103	167-0104	167-0105	167-0106	167-0107	167-0108	167-0109	167-0110	167-0111	167-0112	167-0113	167-0114	167-0115	167-0116	167-0117	167-0118	167-0119	167-0120	167-0121	167-0122	167-0123	167-0124	167-0125	167-0126	167-0127	167-0128	167-0129	167-0130	167-0131	167-0132	167-0133	167-0134	167-0135	167-0136	167-0137	167-0138	167-0139	167-0140	167-0141	167-0142	167-0143	167-0144	167-0145	167-0146	167-0147	167-0148	167-0149	167-0150	167-0151	167-0152	167-0153	167-0154	167-0155	167-0156	167-0157	167-0158	167-0159	167-0160	167-0161	167-0162	167-0163	167-0164	167-0165	167-0166	167-0167	167-0168	167-0169	167-0170	167-0171	167-0172	167-0173	167-0174	167-0175	167-0176	167-0177	167-0178	167-0179	167-0180	167-0181	167-0182	167-0183	167-0184	167-0185	167-0186	167-0187	167-0188	167-0189	167-0190	167-0191	167-0192	167-0193	167-0194	167-0195	167-0196	167-0197	167-0198	167-0199	167-0200																																																																		

Appendix B

CALIBRATIONS AND PROBE TRACKS, C-BAND

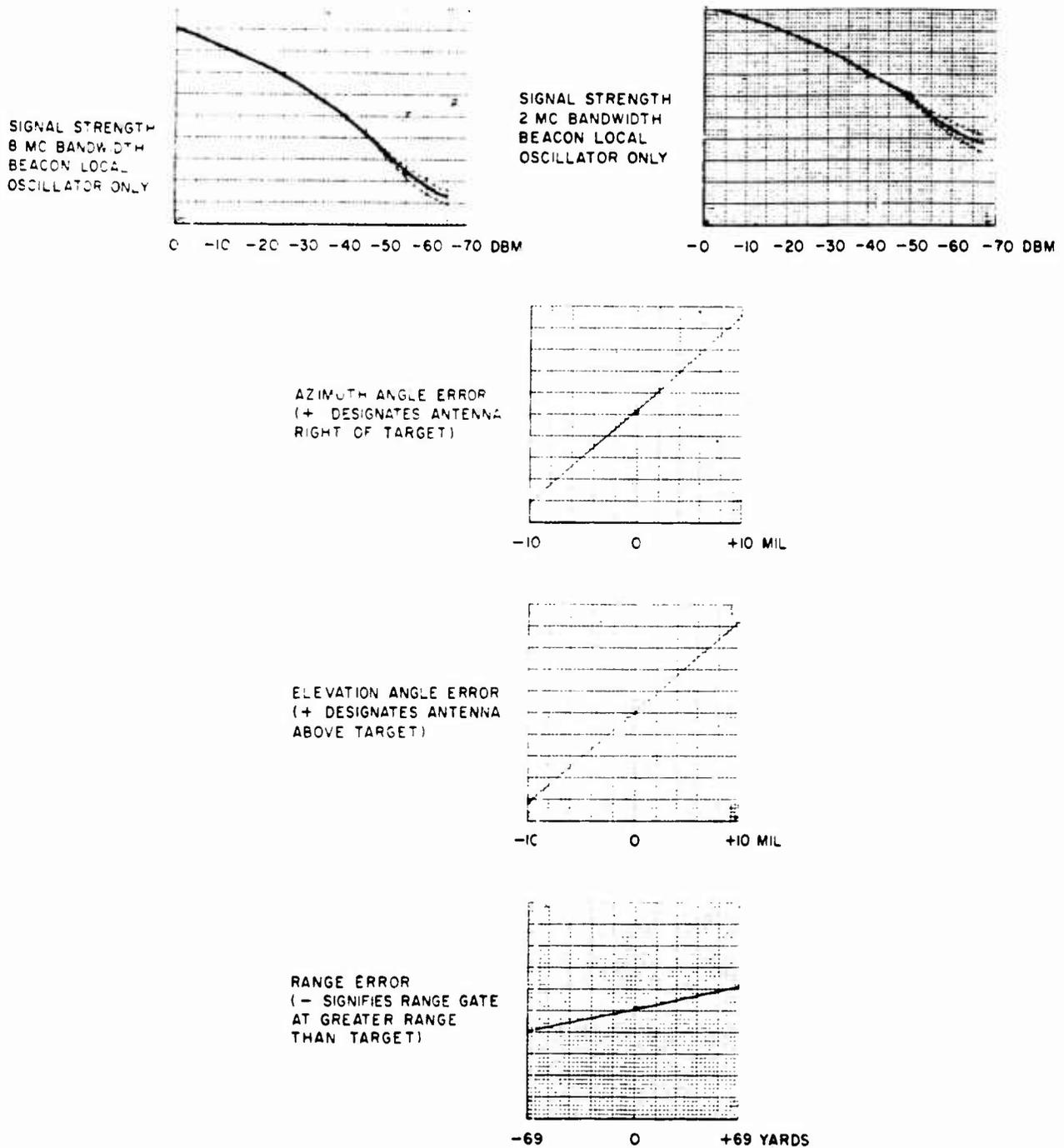


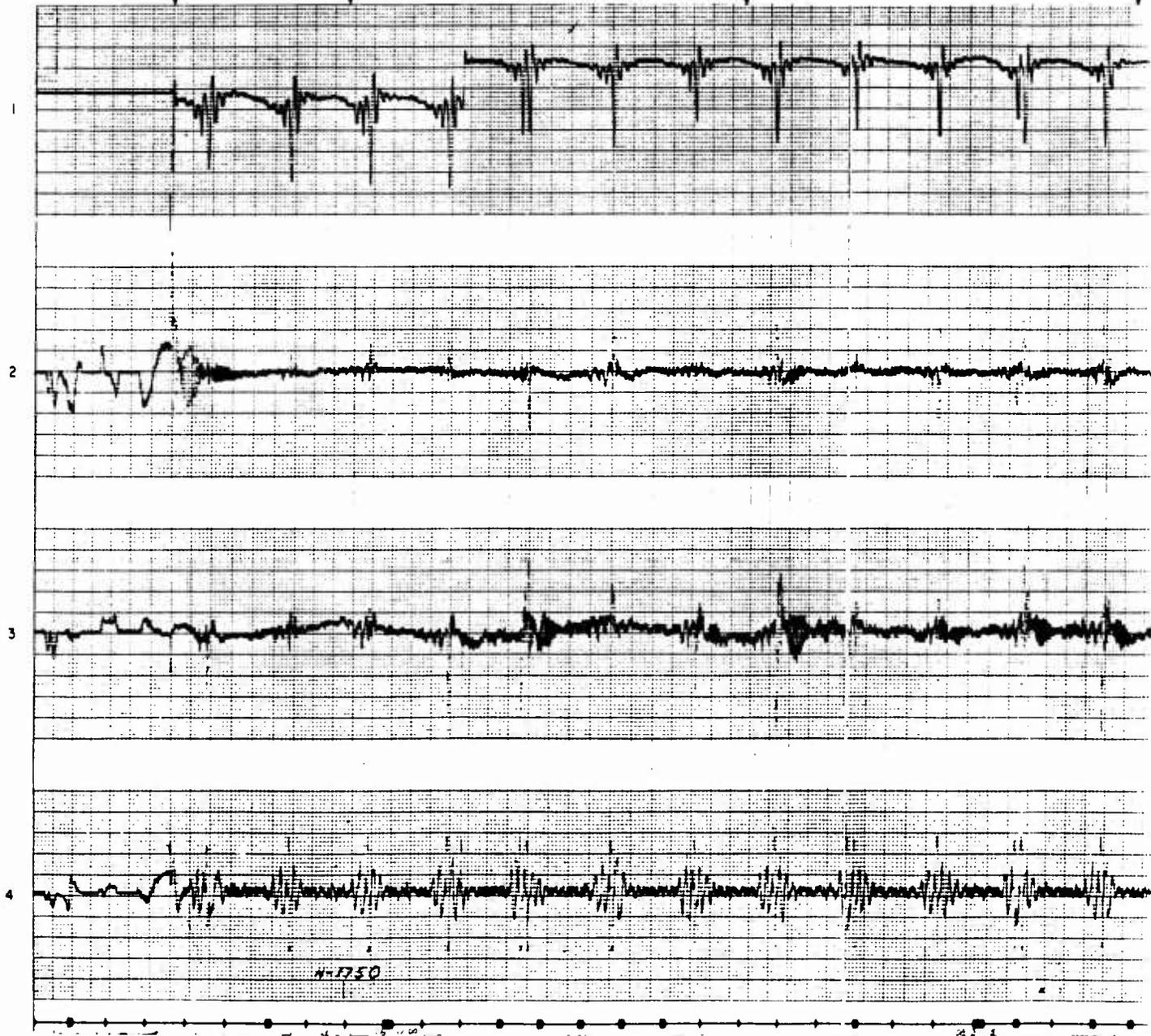
Figure B.1 Calibrations.

LOCKON-AUTO
TRACK MODE

H-1750

H-1740

H-17



- 1 - AGC
- 2 - AZ ERROR
- 3 - EL ERROR
- 4 - RANGE ERROR

135-1

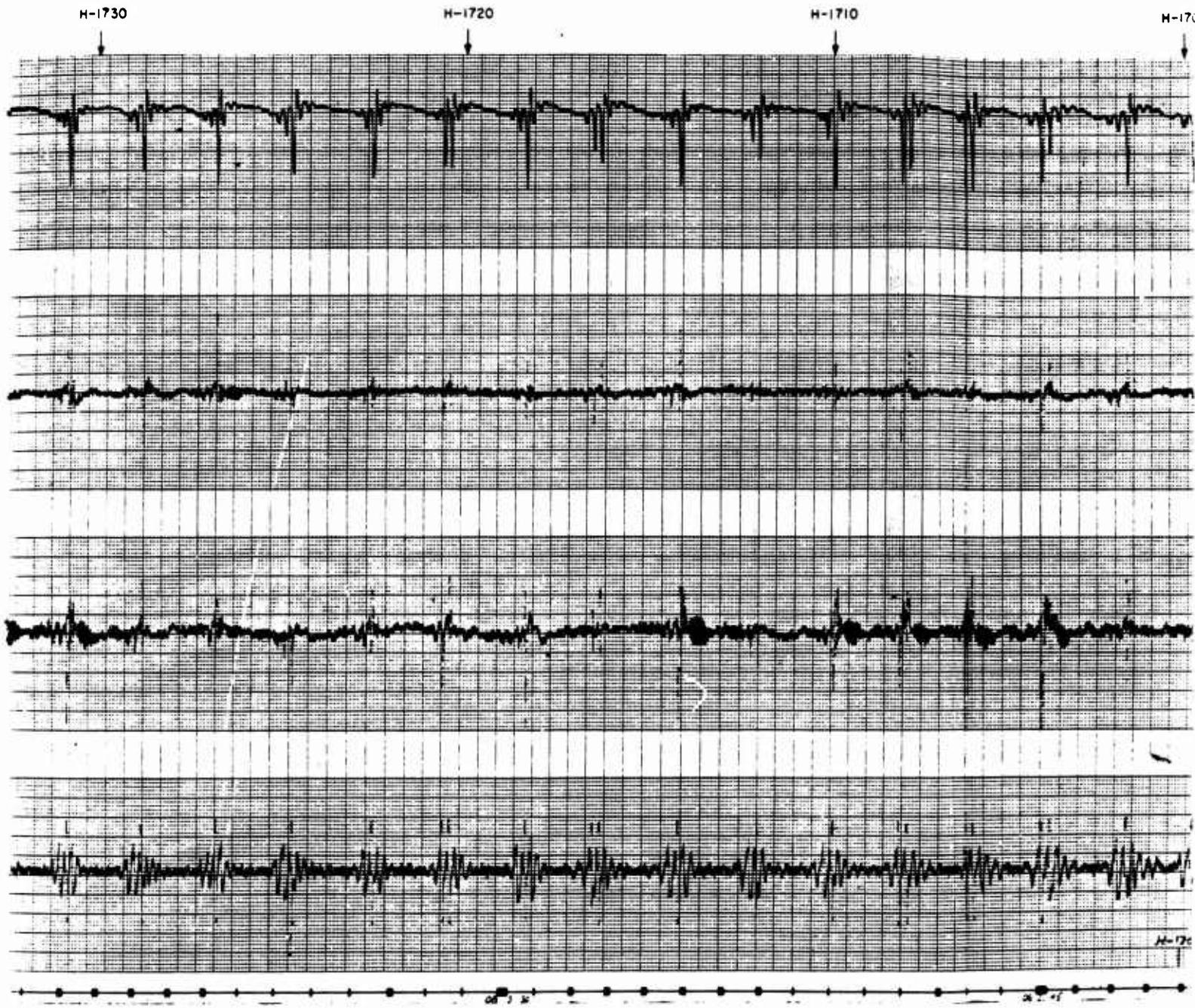


Figure B.2 Track, Probe 1.



Trace 1.

353

H-1660

H-1670

H-1660



135.4

H-1650

H-1640



- 1-AGC
- 2-AZ ERROR
- 3-EL ERROR
- 4-RANGE ERROR

136-1



H-1630

H-1620

H-1610

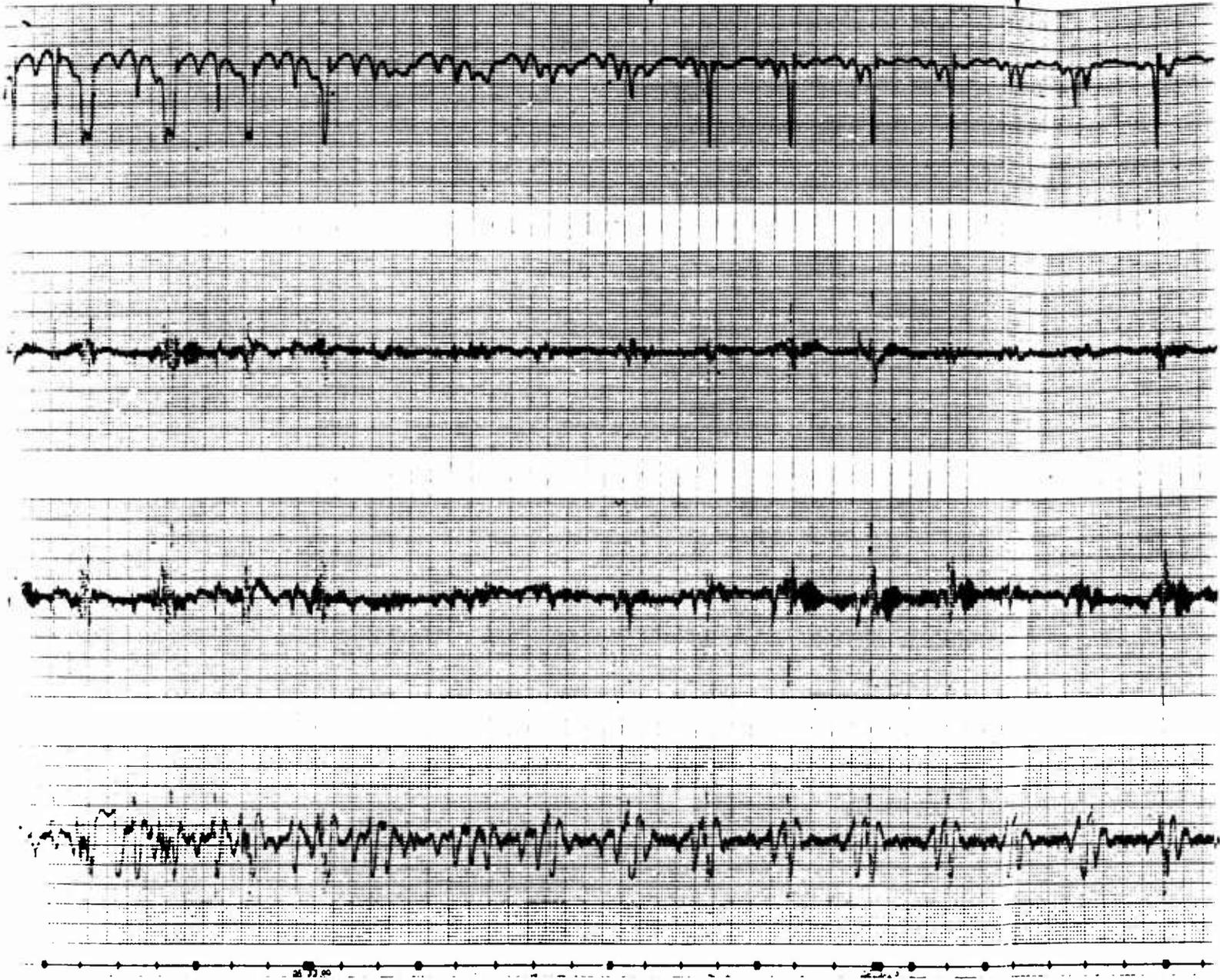


Figure B.2 Continued.





ECG recording

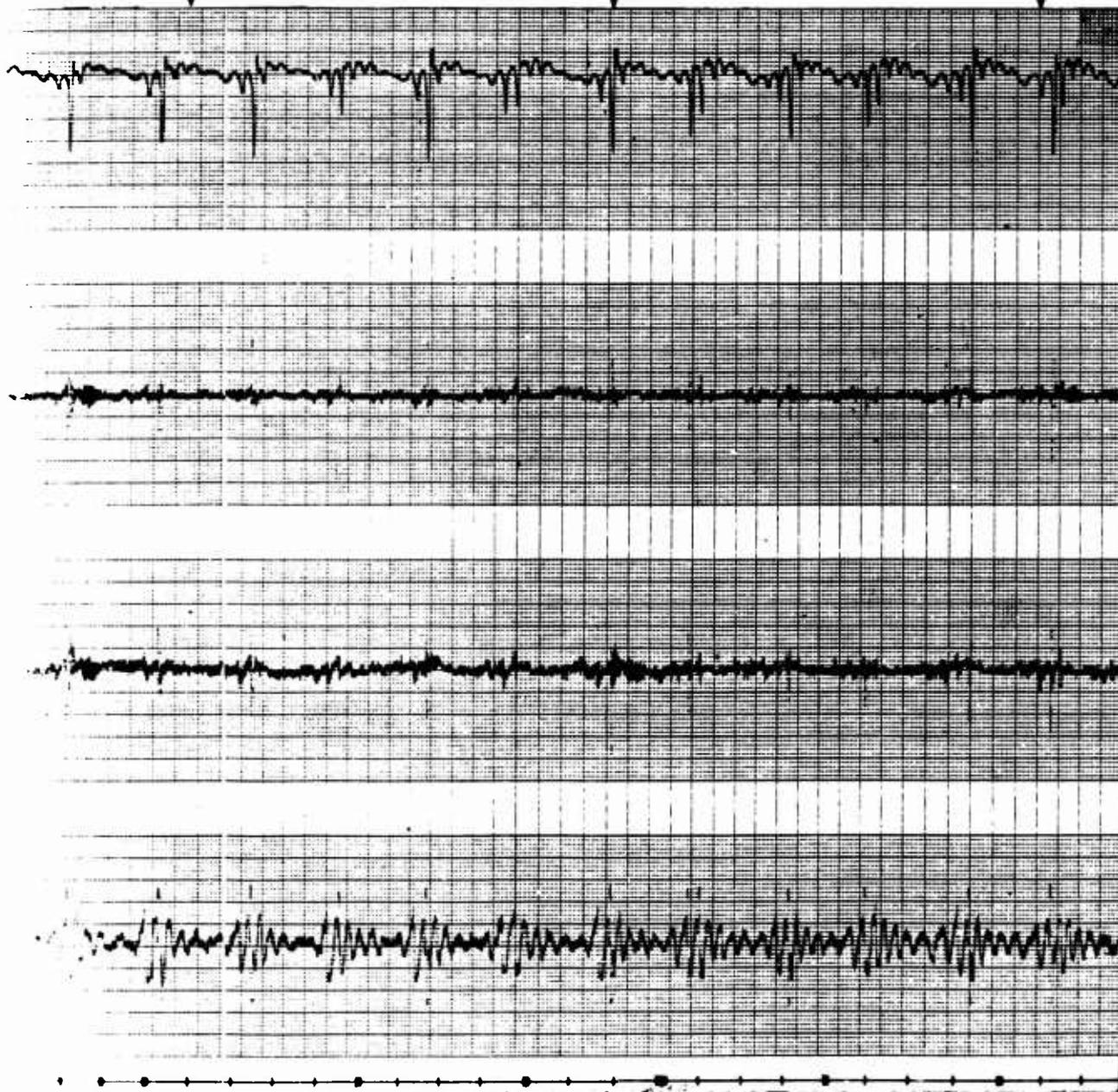
108 - 3



H-1580

H-1570

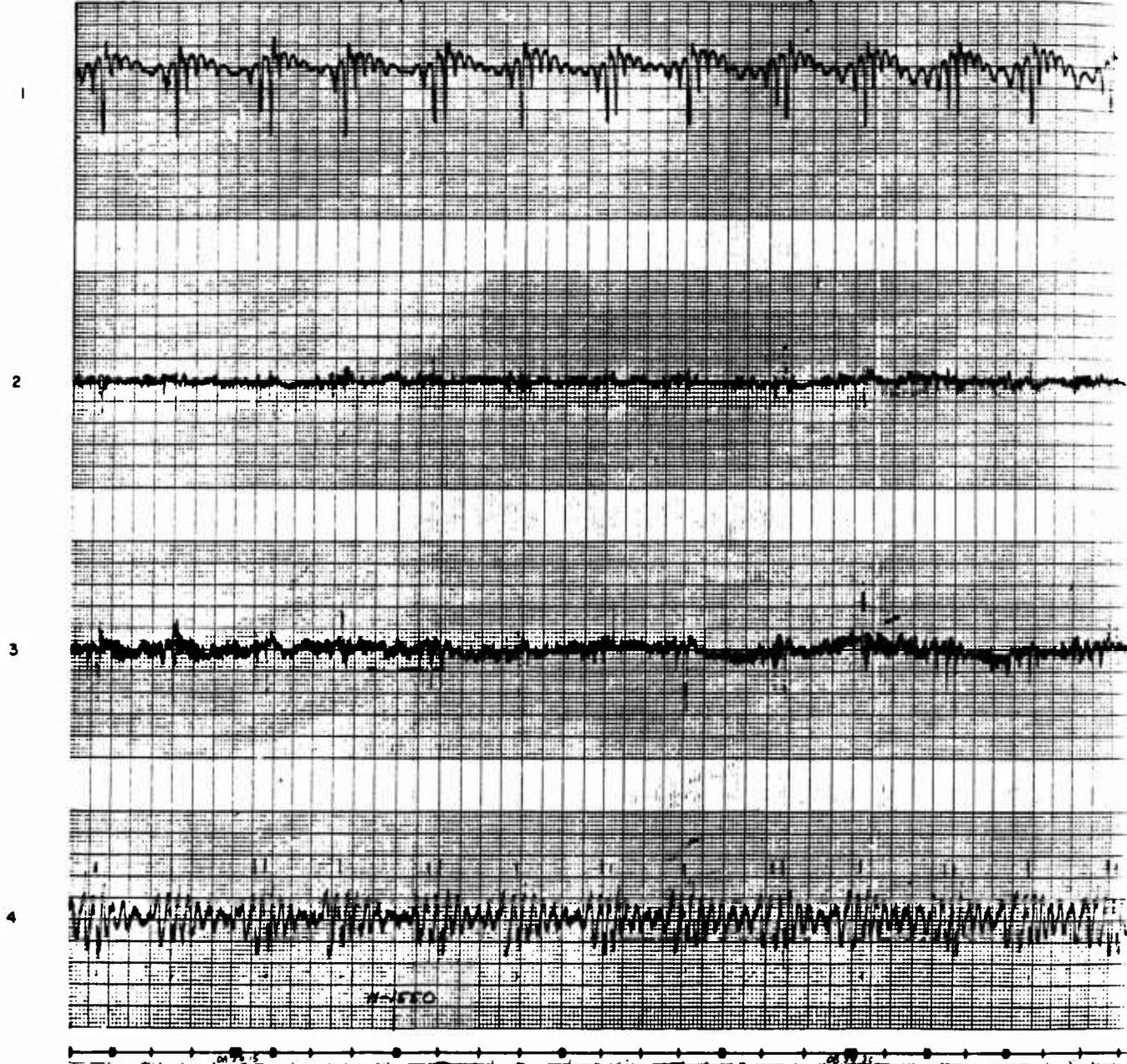
H-1560



136-4

H-1550

H-1540



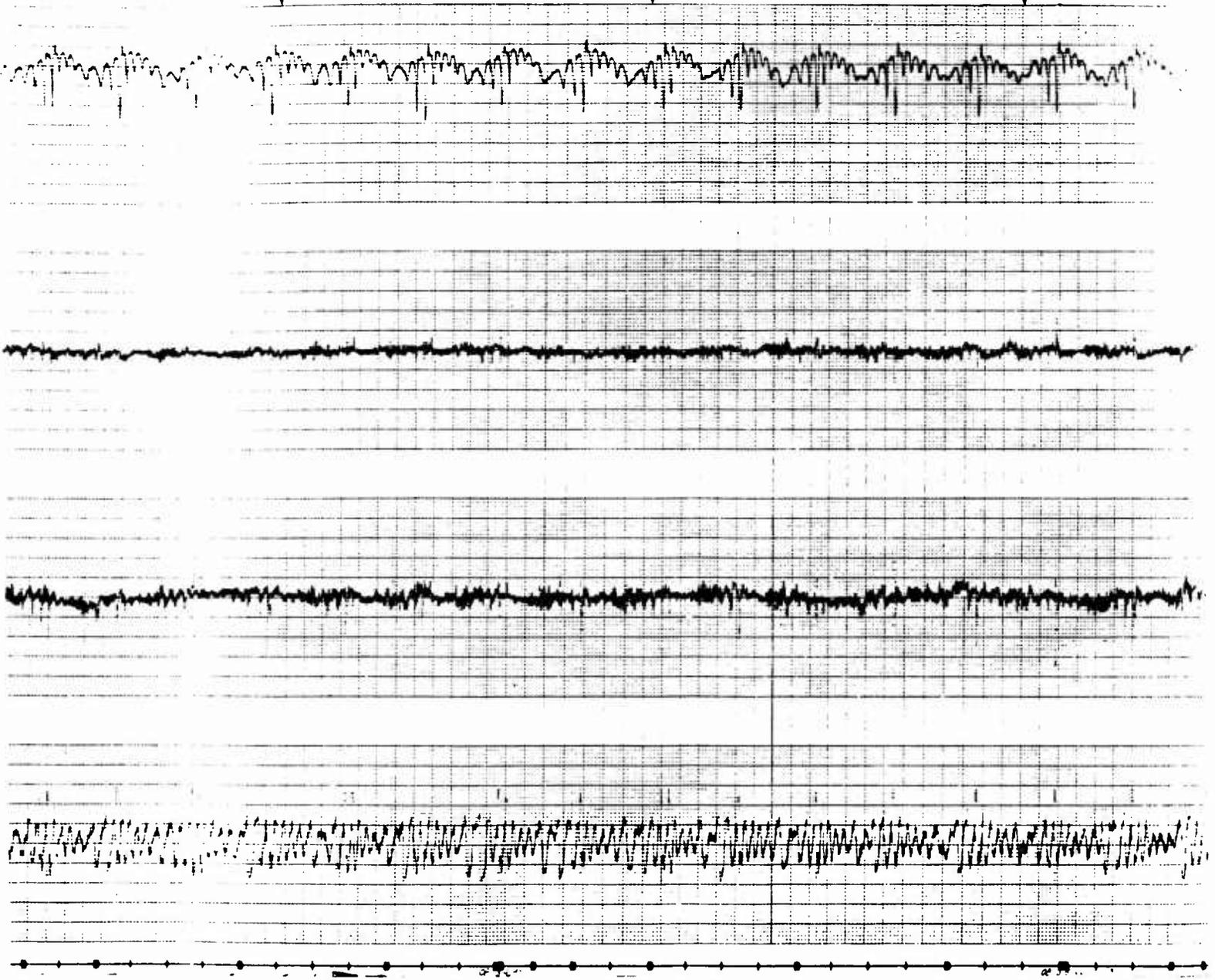
- 1-AGC
- 2-AZ ERROR
- 3-EL ERROR
- 4-RANGE ERROR

137-1

H-151

H-152C

H-1510



137-2



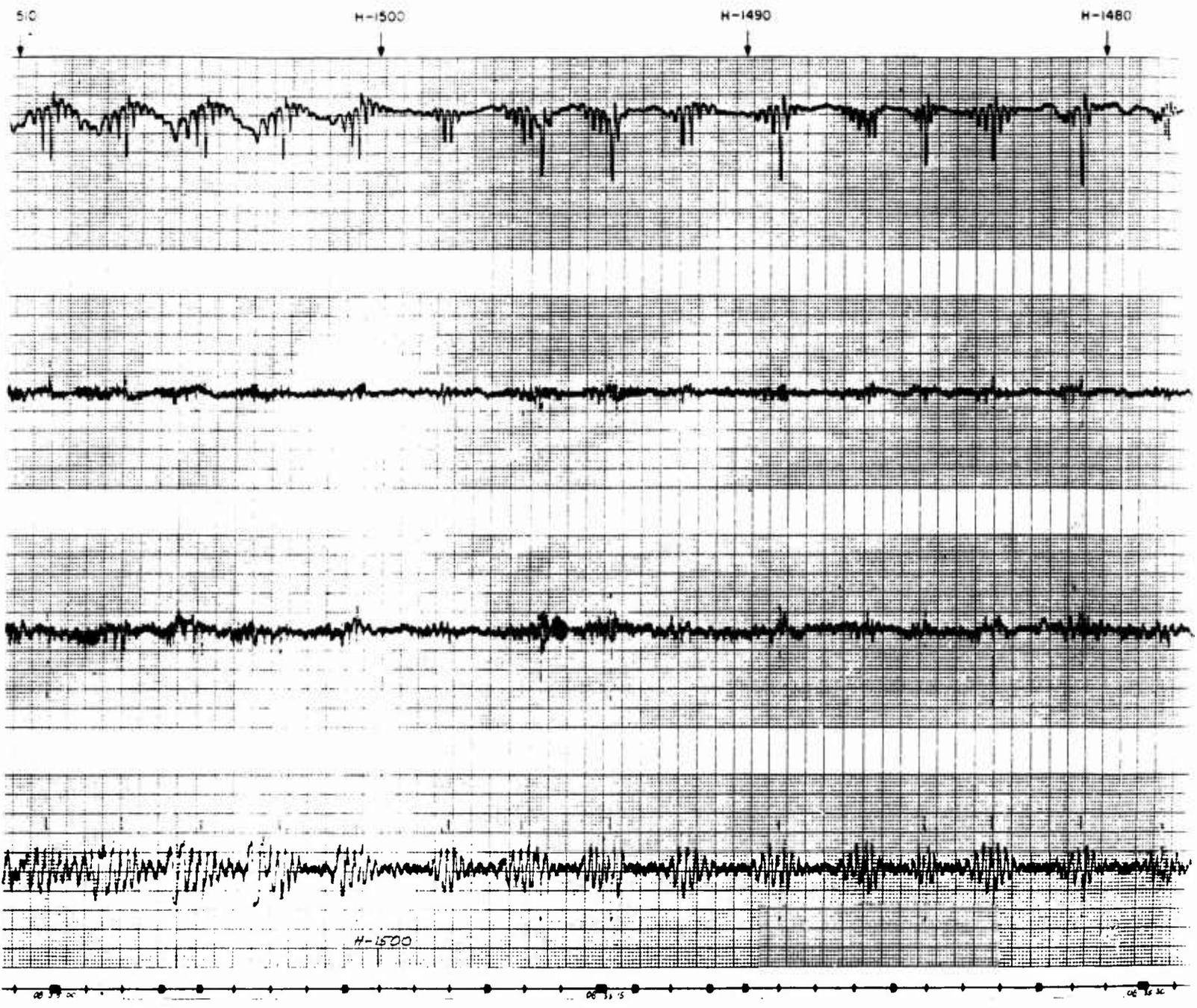


Figure B.2 Continued.



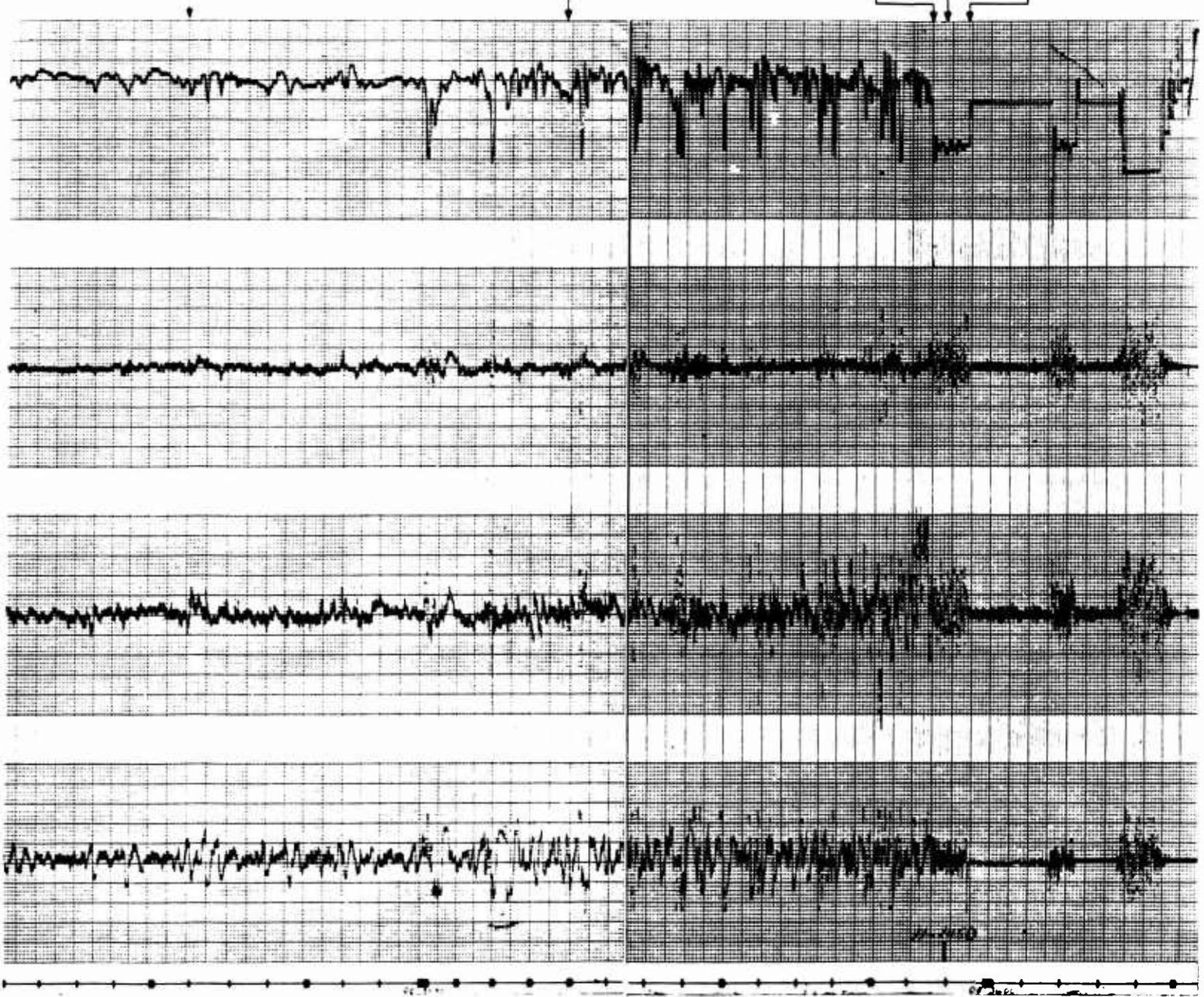
H-1470

H-1460

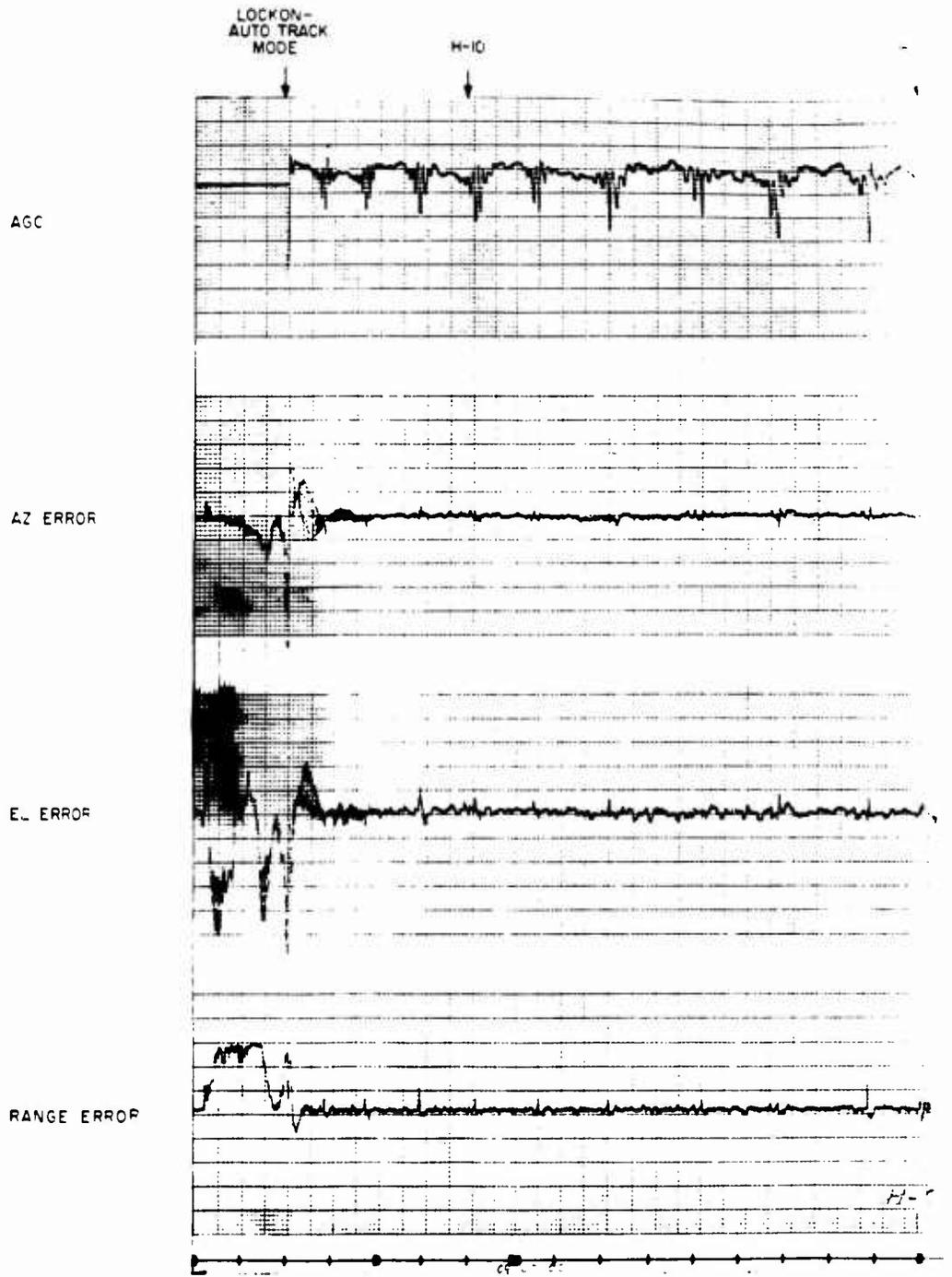
LOST TRACK

H-1450

MANUAL MODE



137-4



Figure

138-1



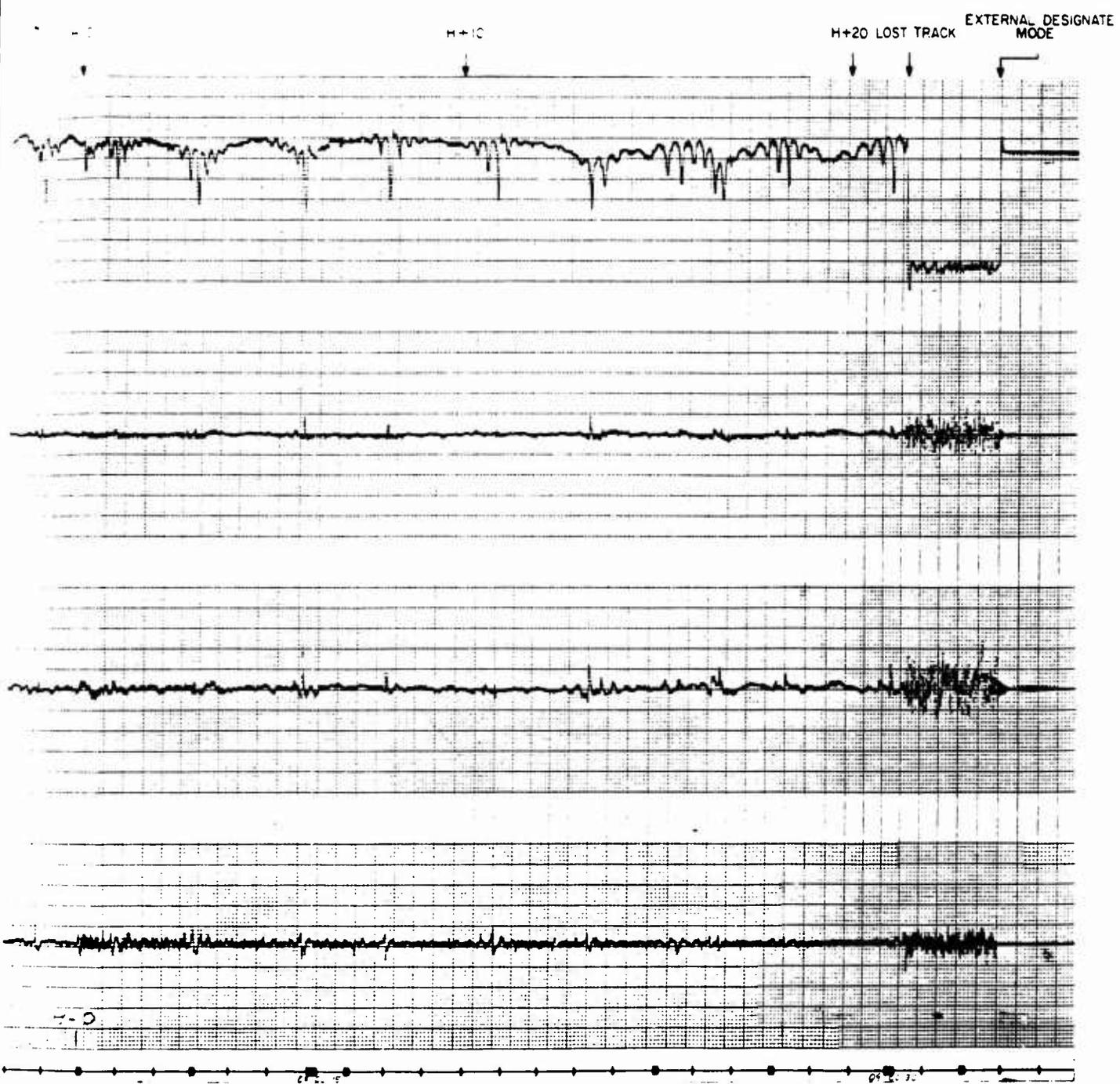


Figure B.3 Track, Probe 3.

138 - Z

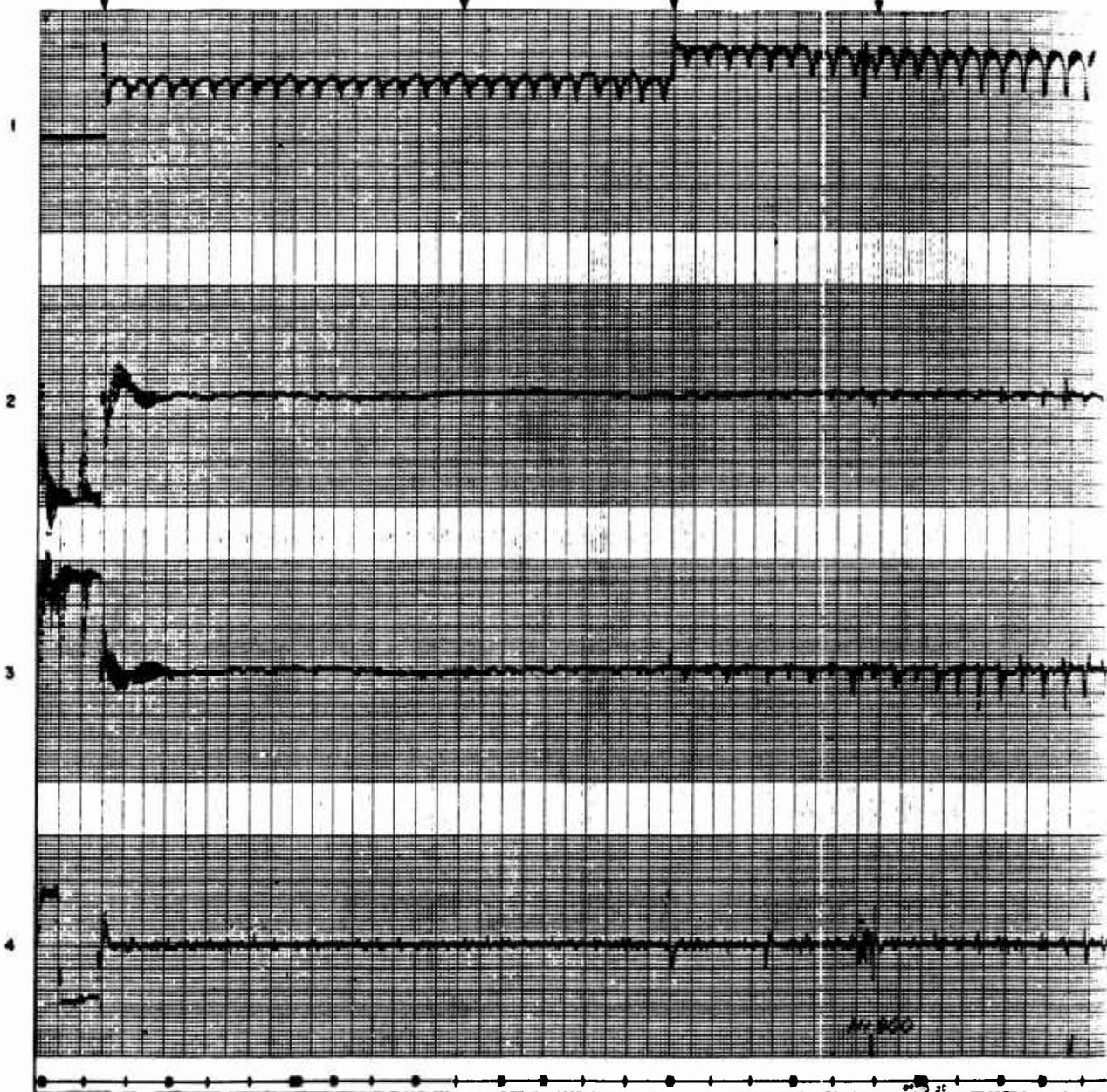


LOCKON-
AUTO TRACK MODE

H+790

RECEIVER
BANDWIDTH 2 MC

H+800



- 1 - AGC
- 2 - AZ ERROR
- 3 - EL ERROR
- 4 - RANGE ERROR

139-1



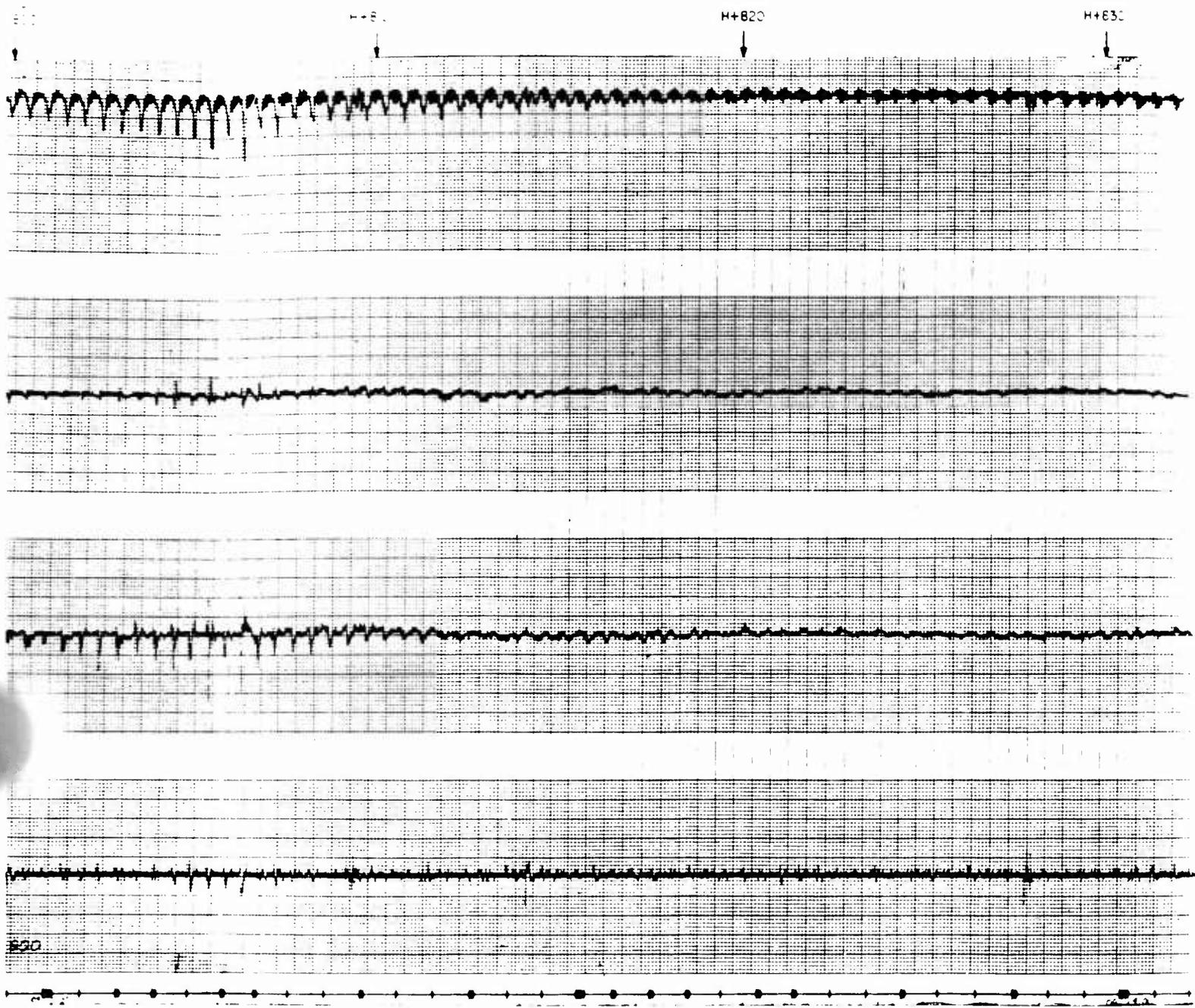
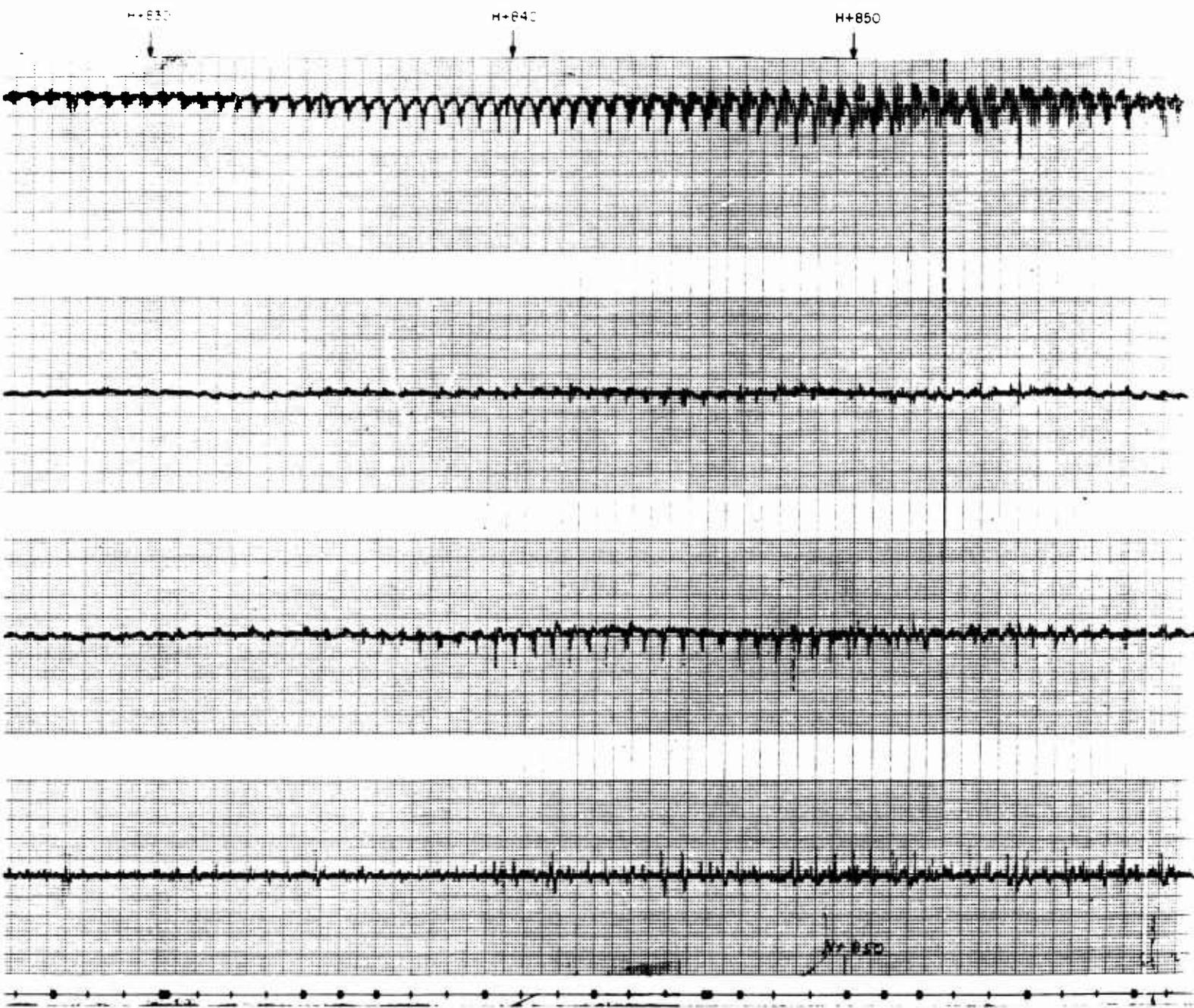


Figure B.4 Track. Probe





Track. Probe 4.

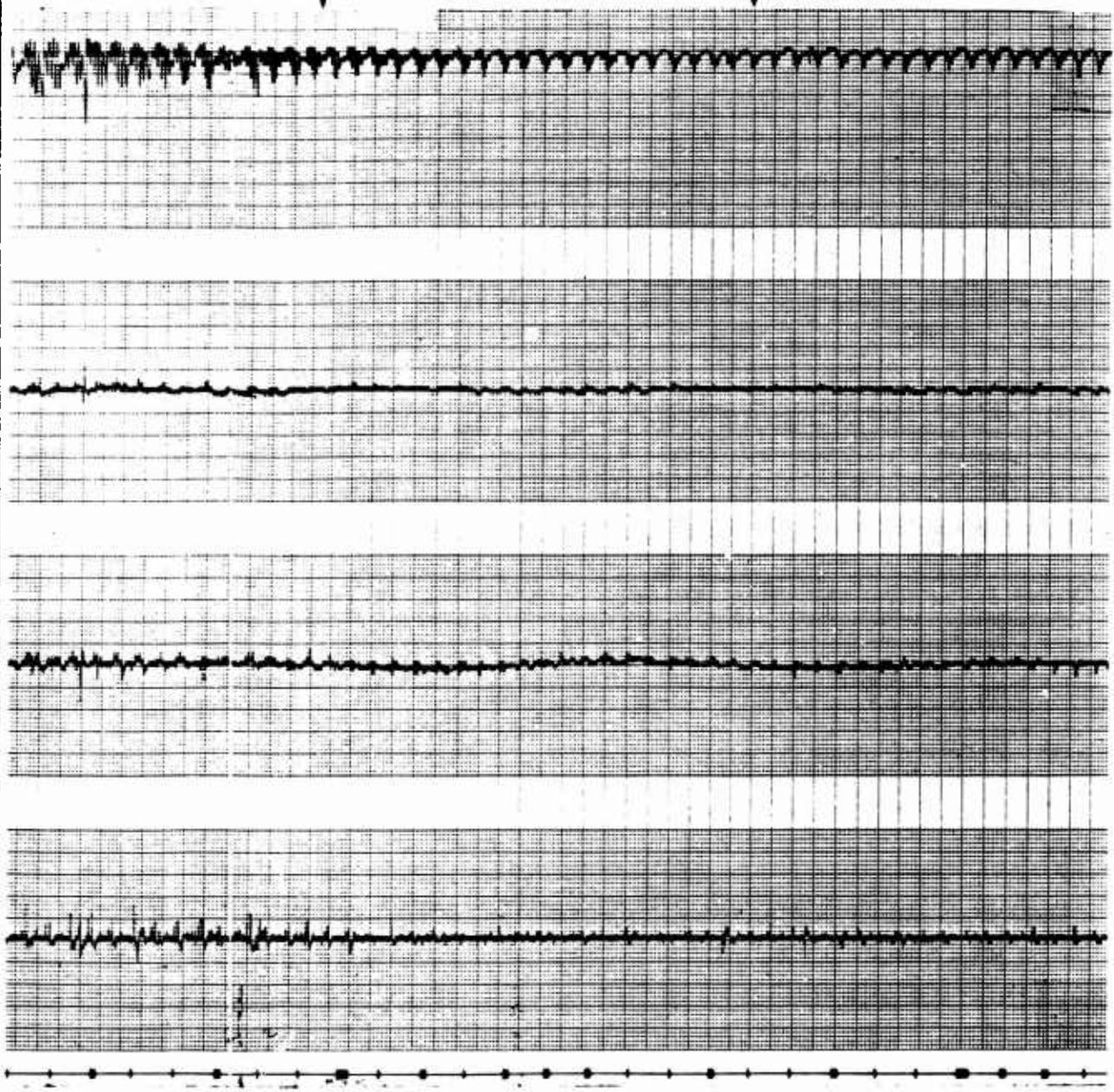
139 - 3

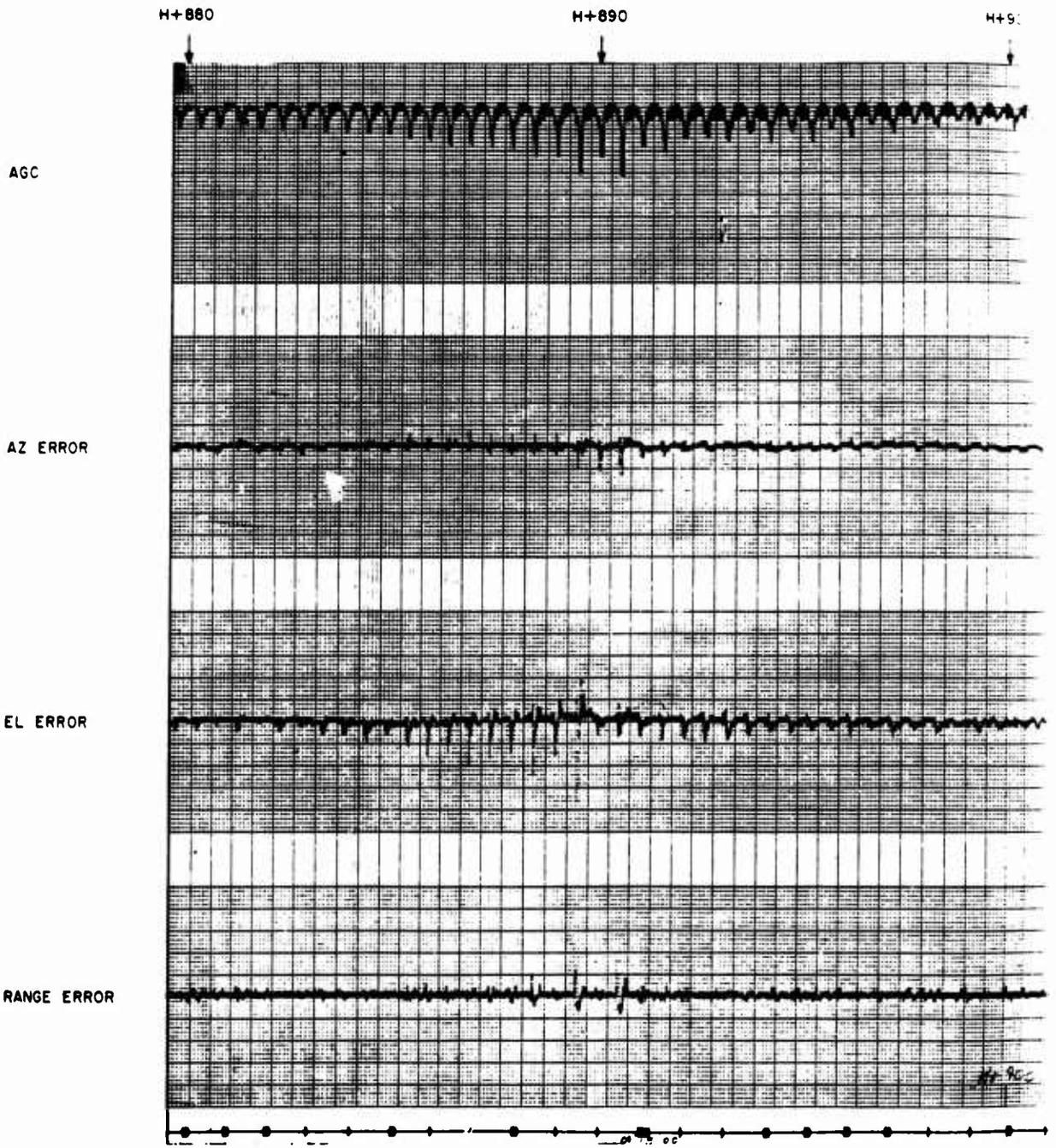


139-3

H+560

H+870





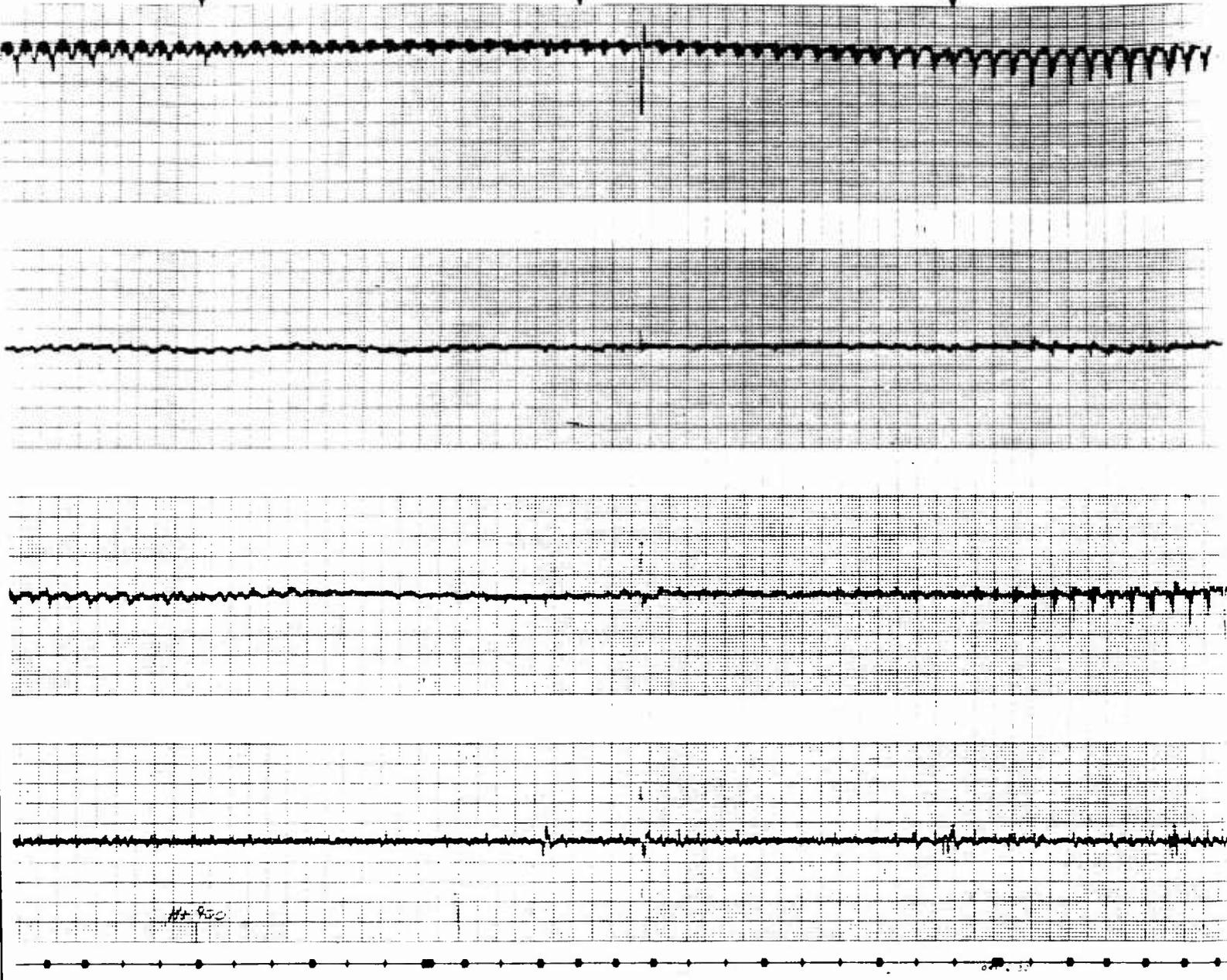
140-1



H+91

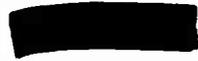
H+90

H+920



H+950

Figure B.4 Continued.



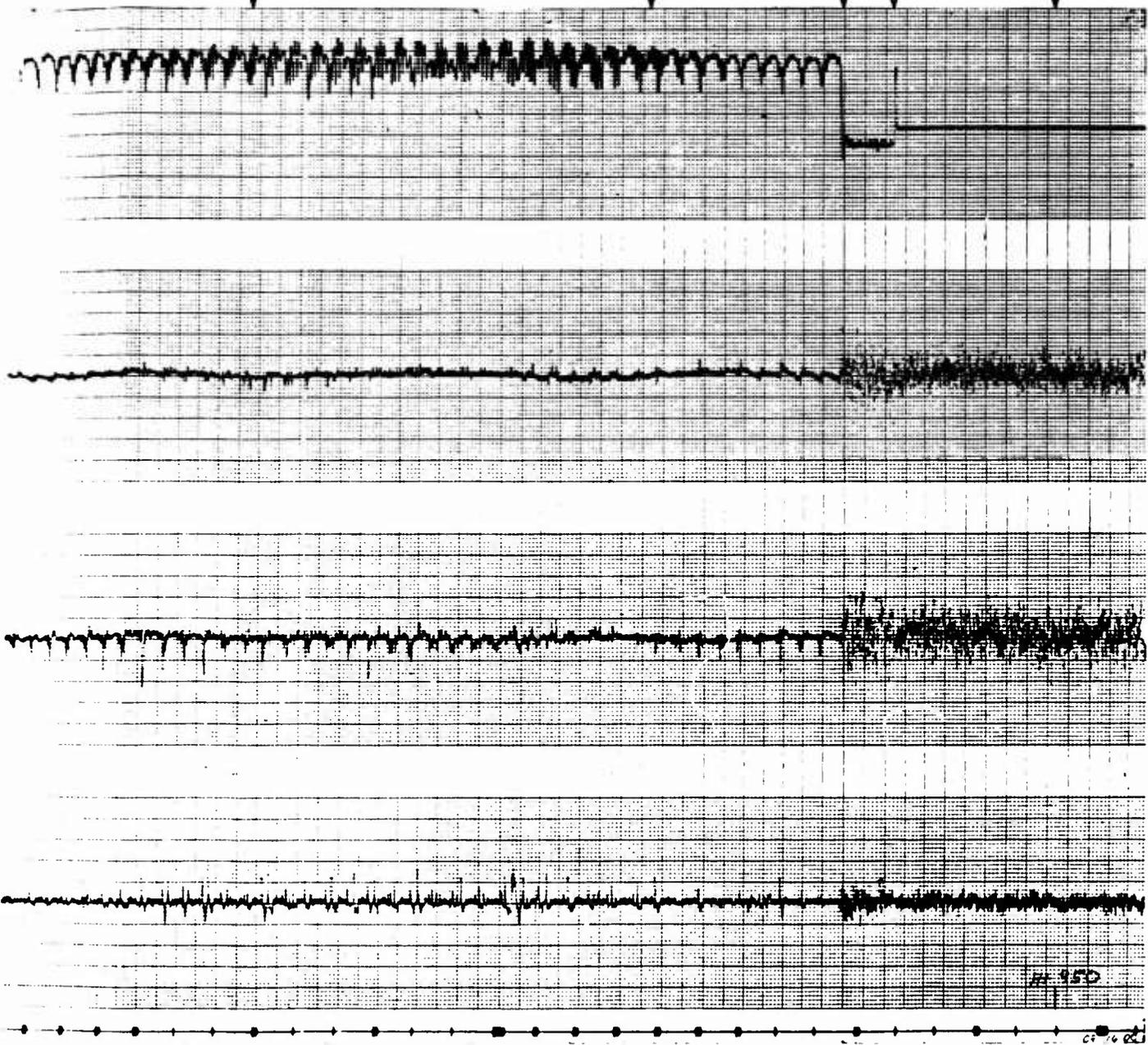
H+930

H+940

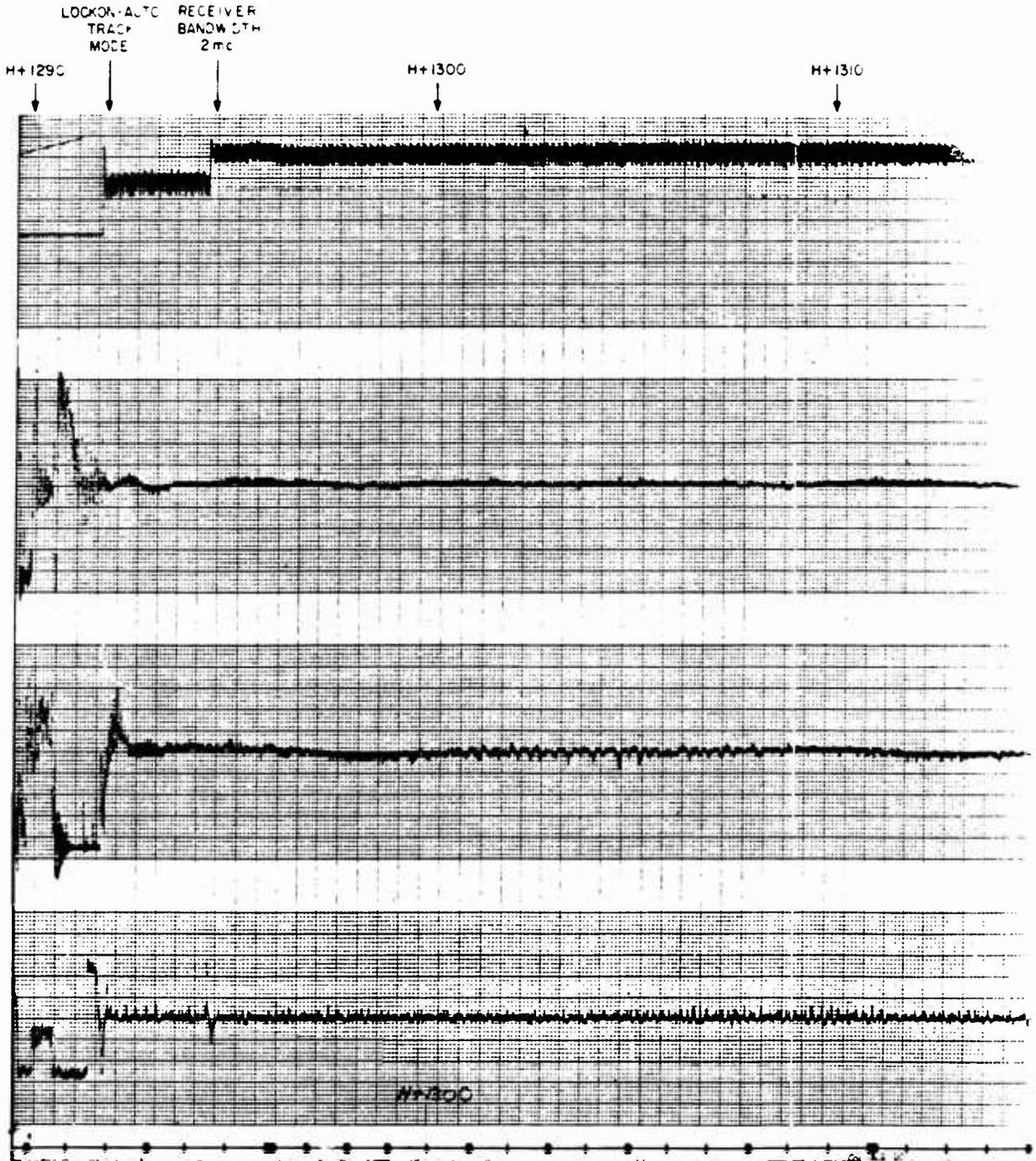
LOST TRACK

EXTERNAL DESIGNATE MODE

H+950



1403



- 1 - AGC
- 2 - AZ ERROR
- 3 - EL ERROR
- 4 - RANGE ERROR

141-1

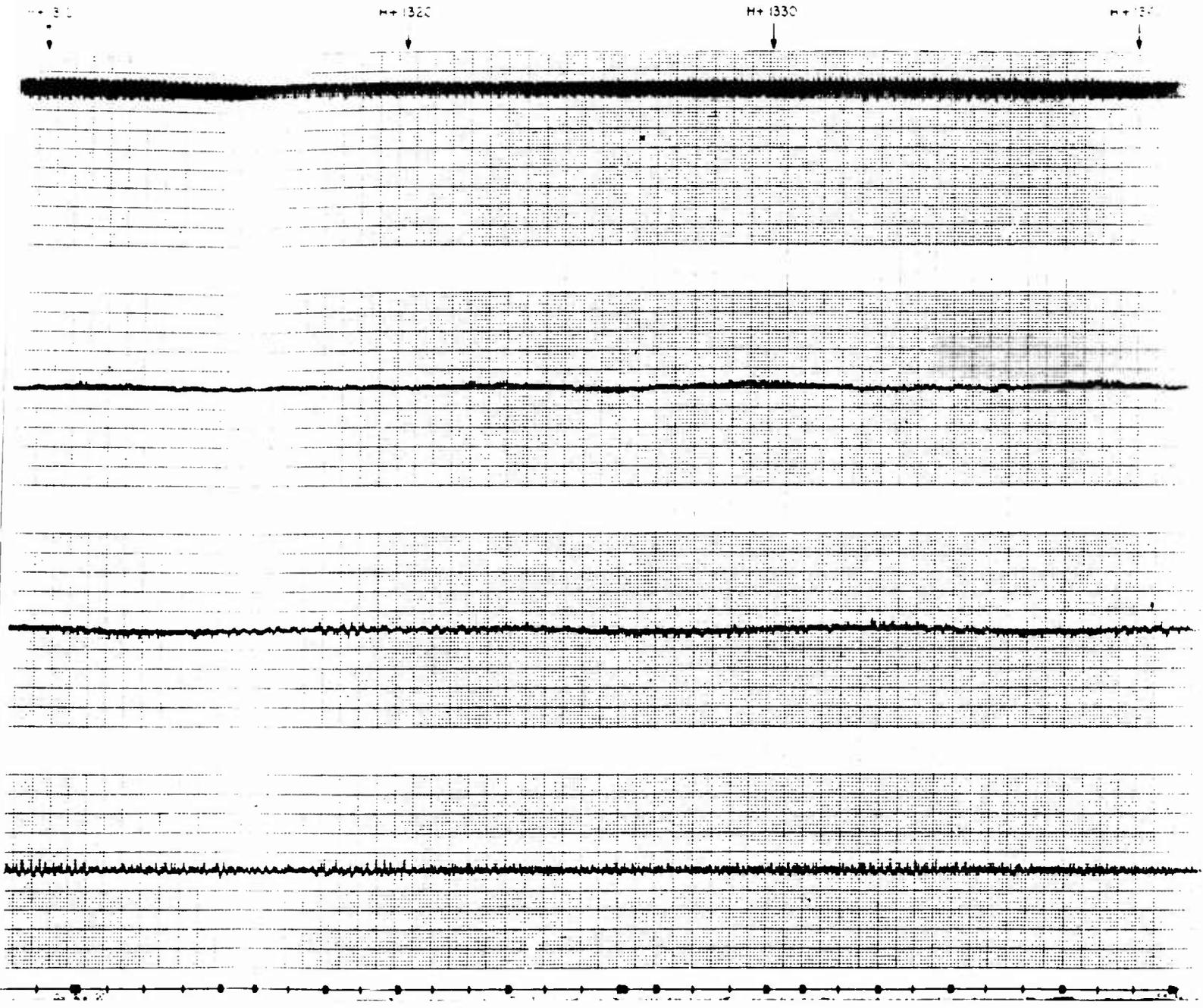


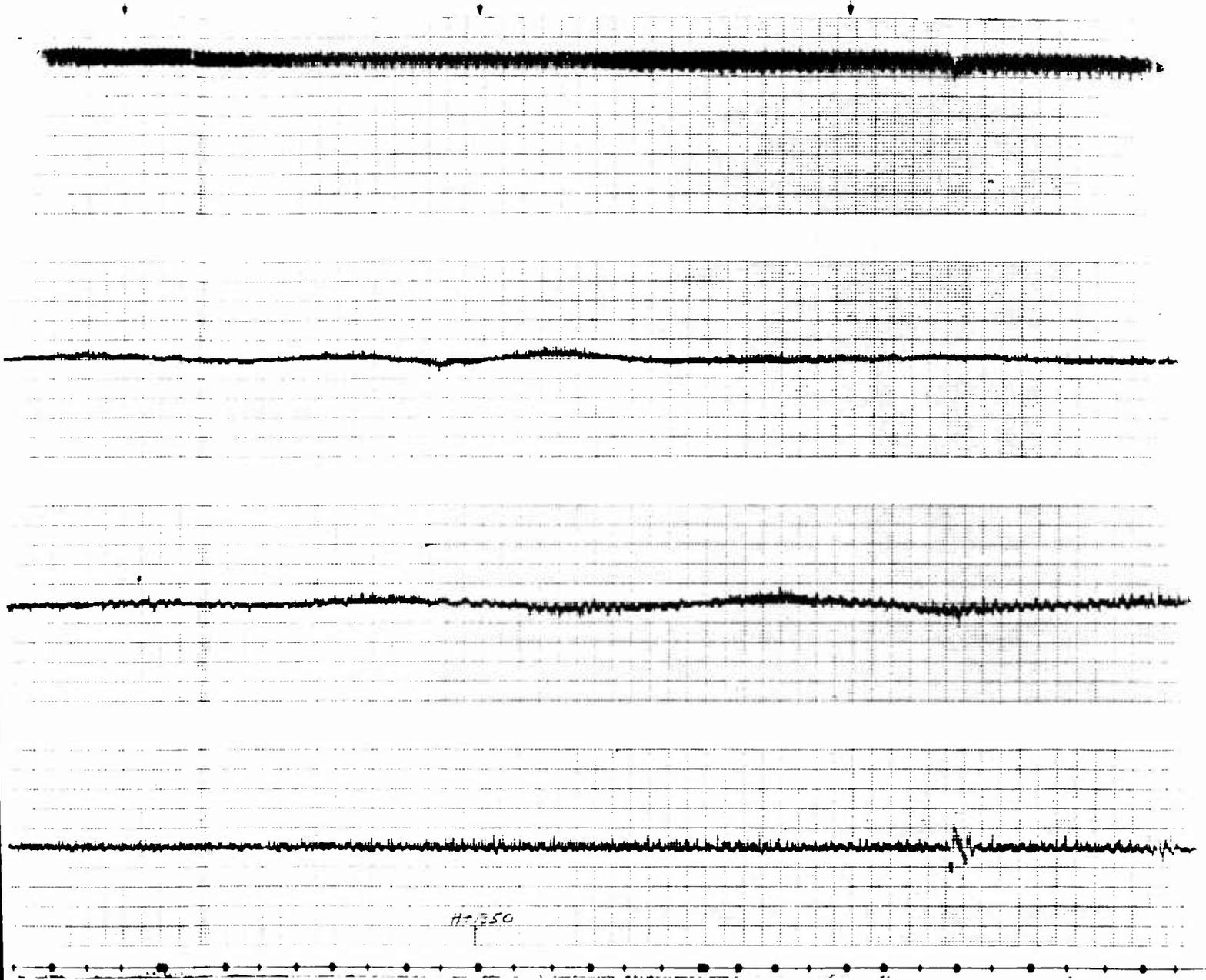
Figure B.5 Track. Probe 5.



H+340

H+350

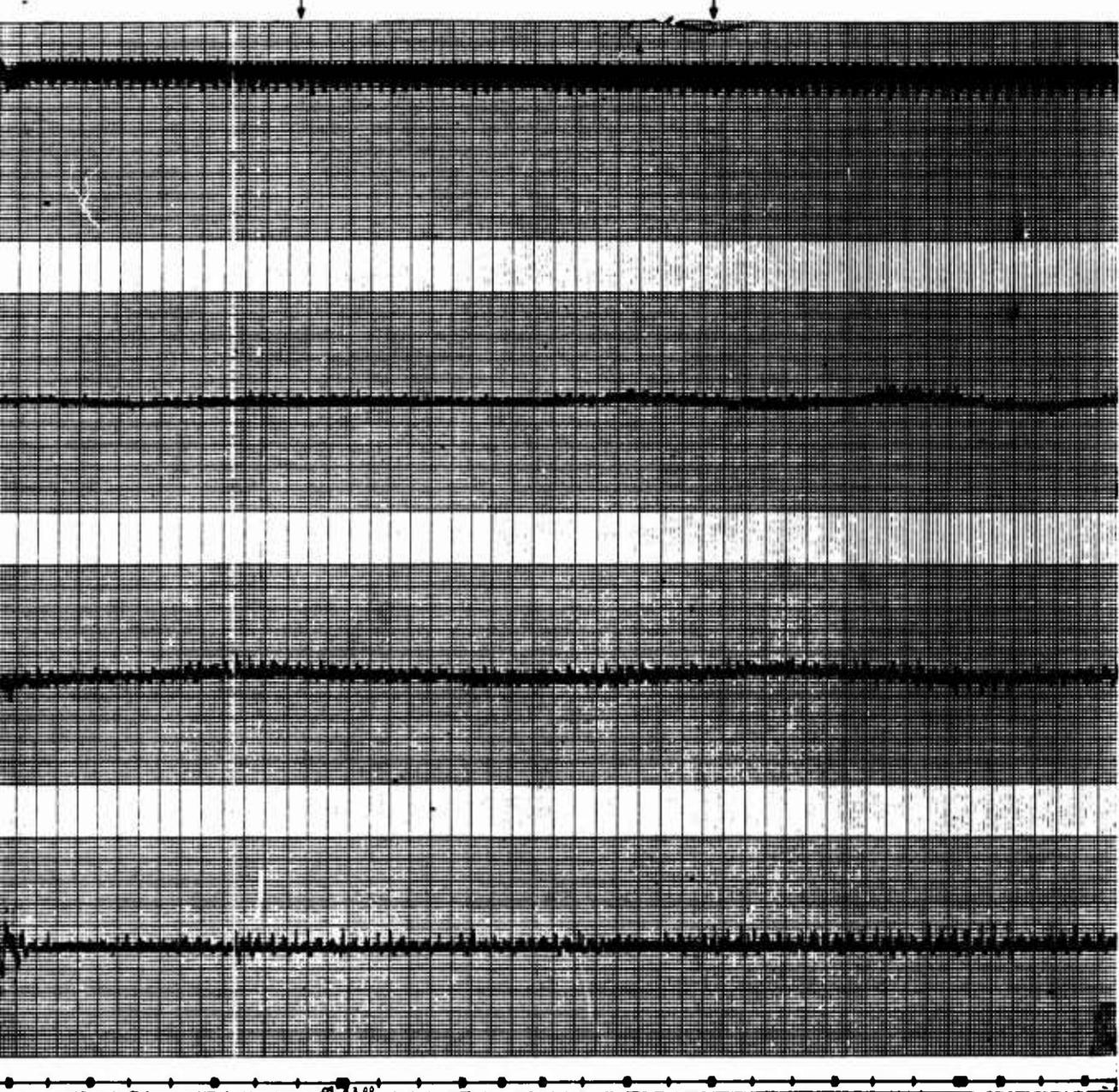
H+360



Probe 5.

H+1370

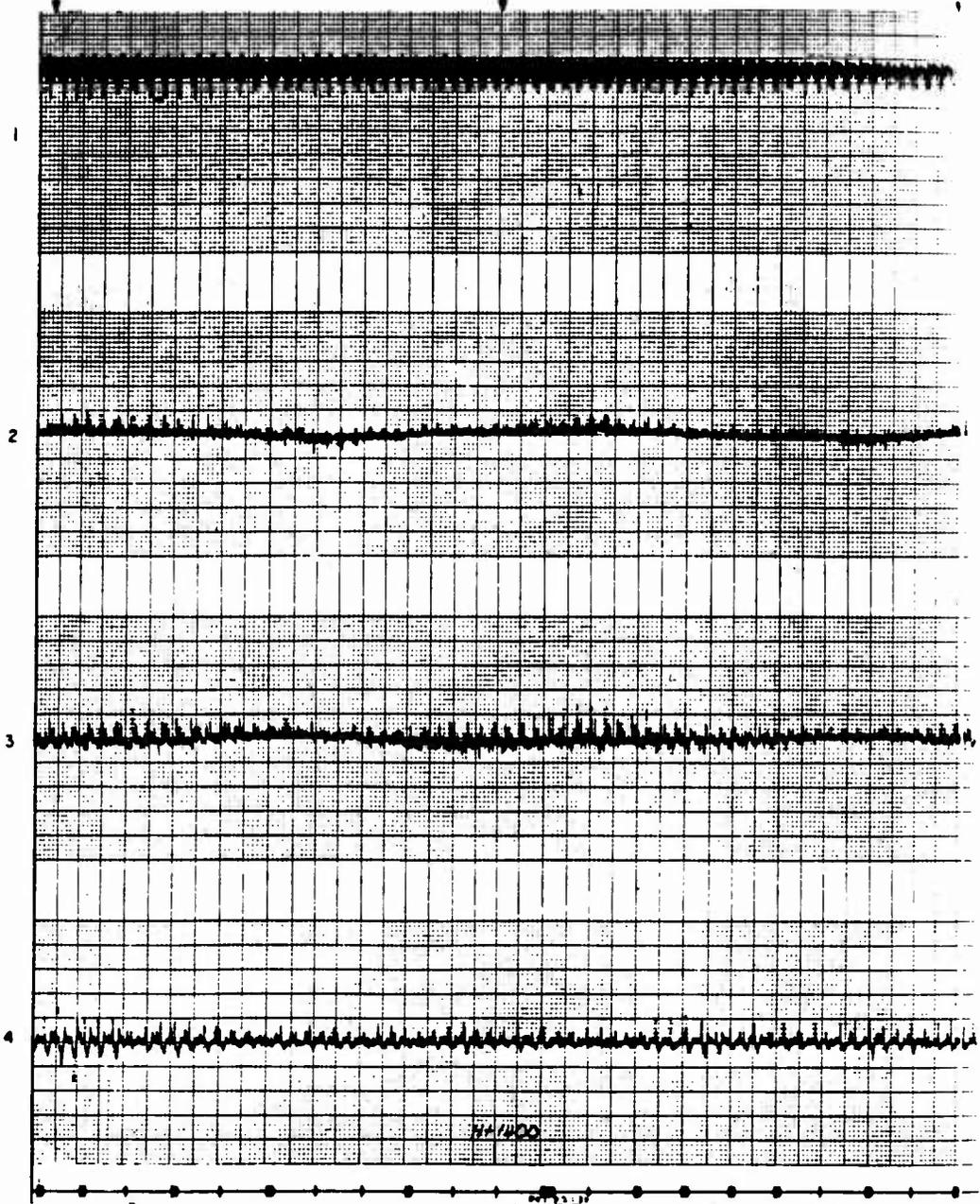
H+1380



H+1390

H+1400

H+



- 1 - AGC
- 2 - AZ ERROR
- 3 - EL ERROR
- 4 - RANGE ERROR

142-1



H + 1410

H + 1420

H + 1430

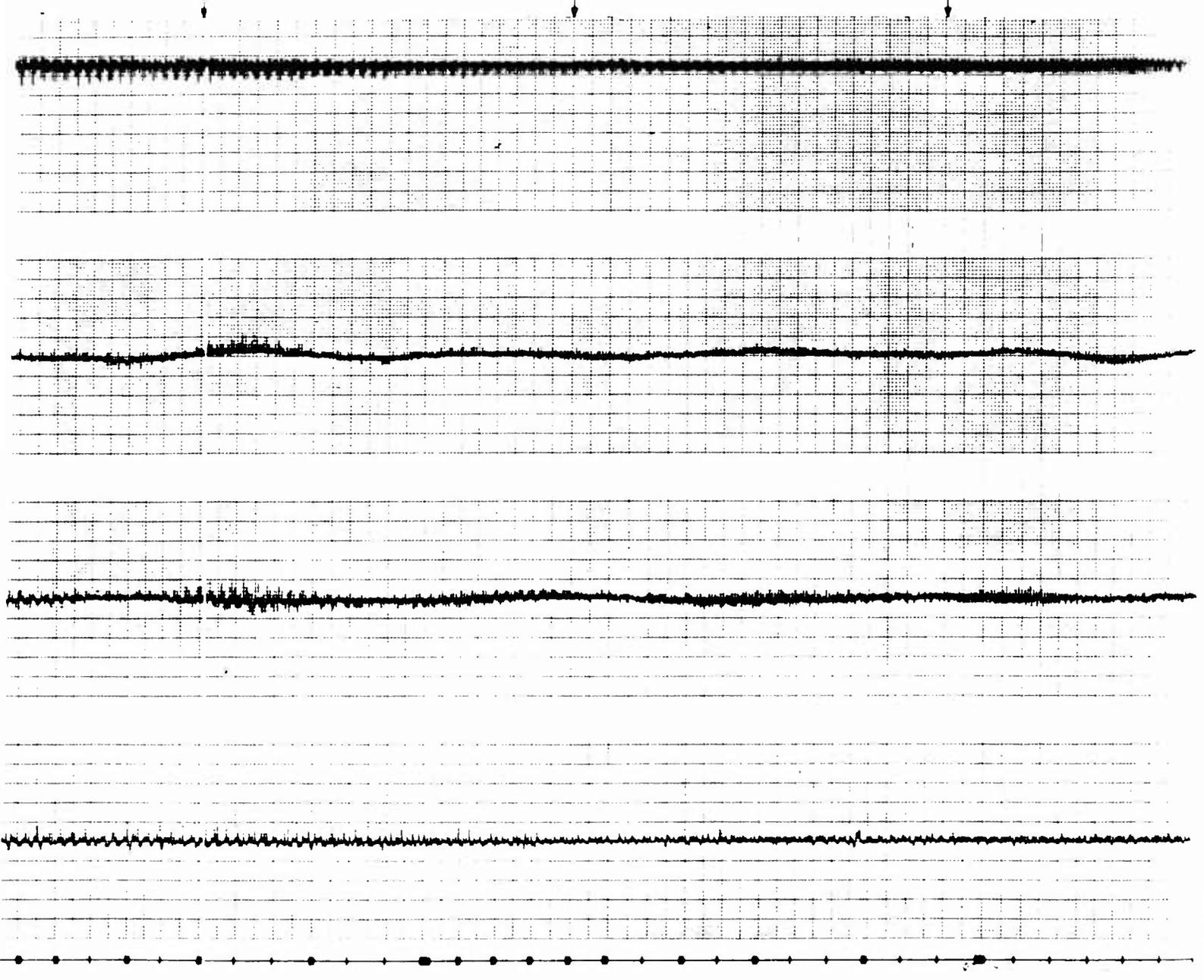


Figure B.5

142-2

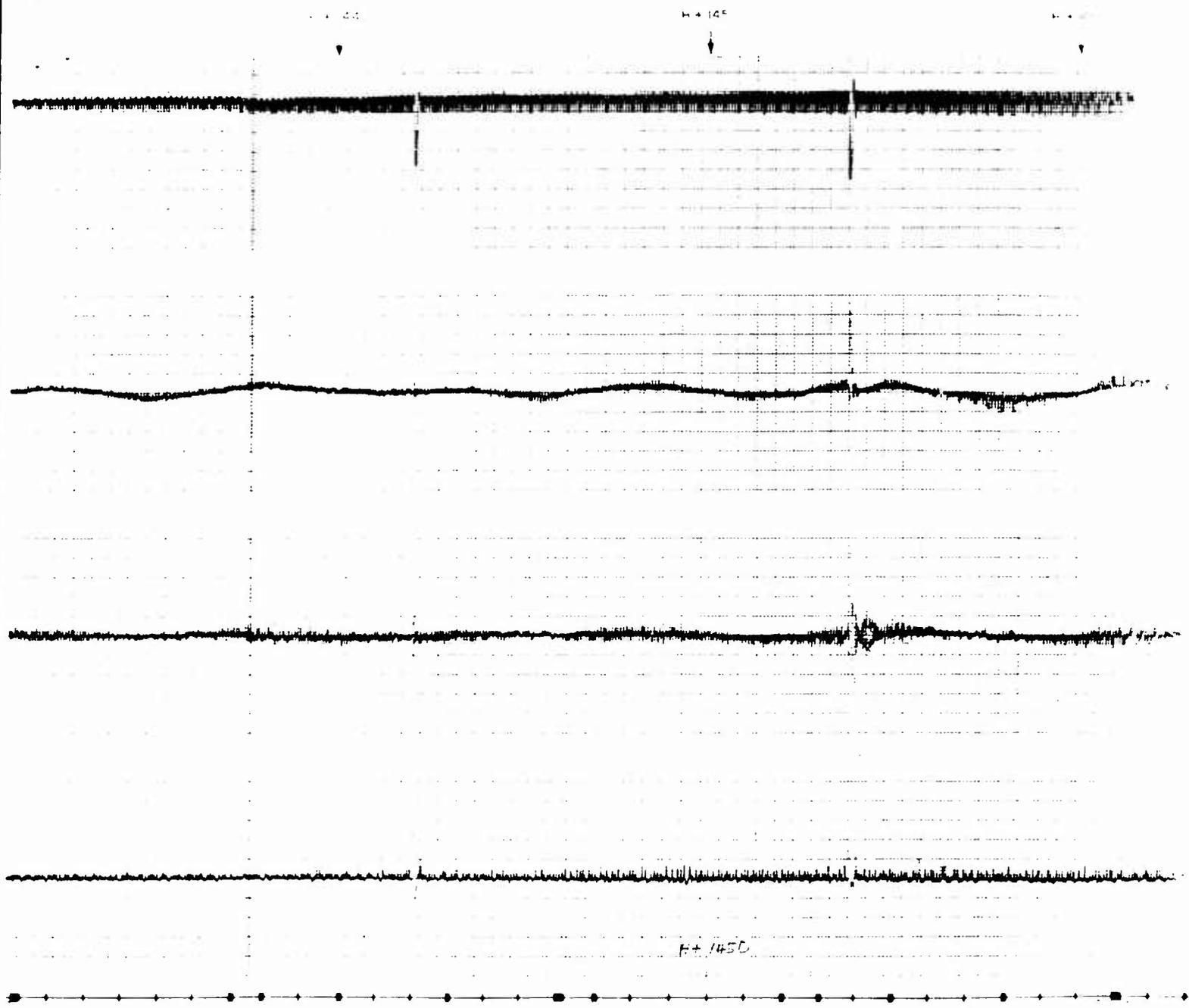


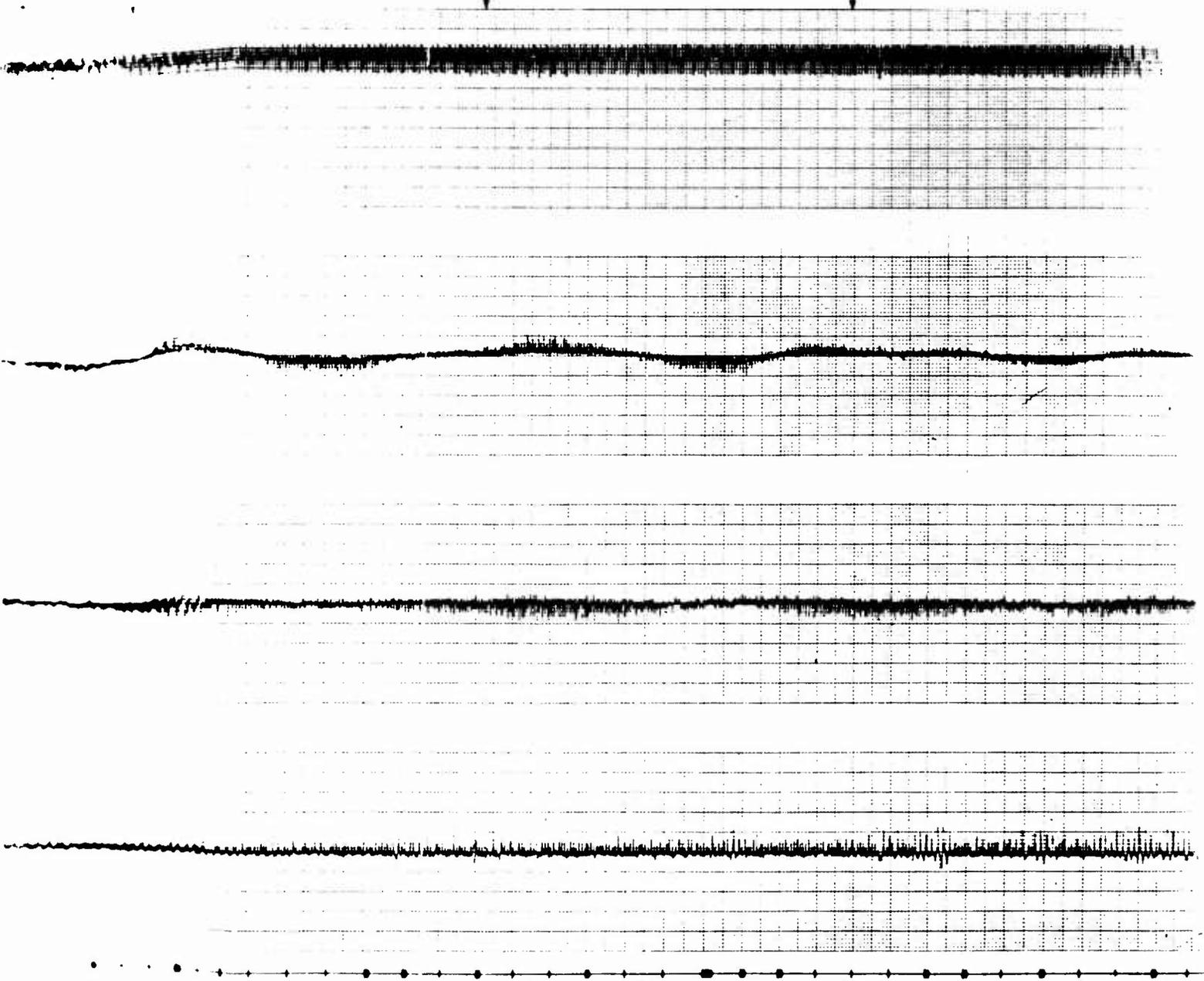
Figure B.5 - Continued.

142-3



H + 1424

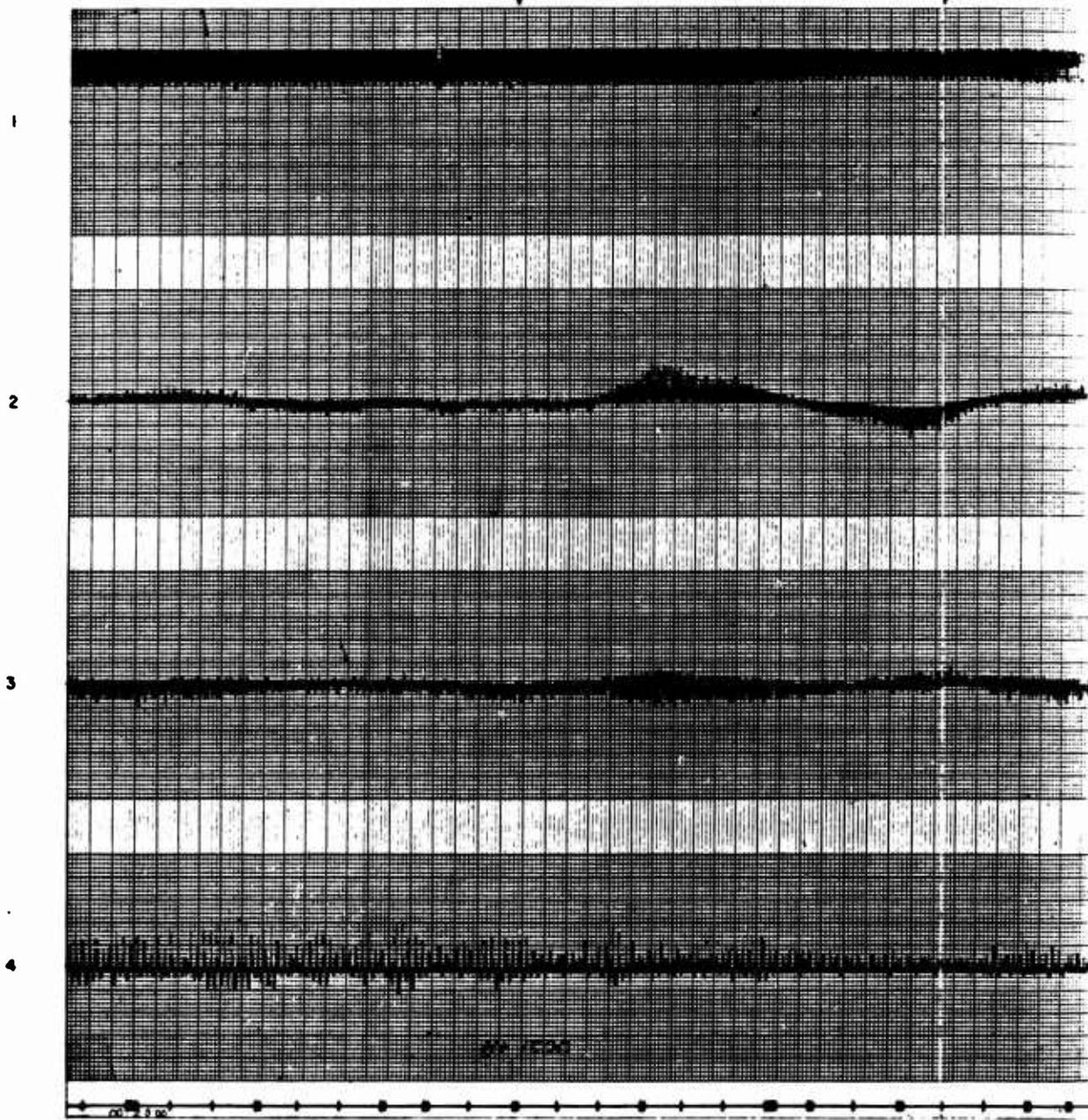
H + 1450



1424

H+1500

H+1510



- 1- AGC
- 2- AZ ERROR
- 3- EL ERROR
- 4- RANGE ERROR

143-1

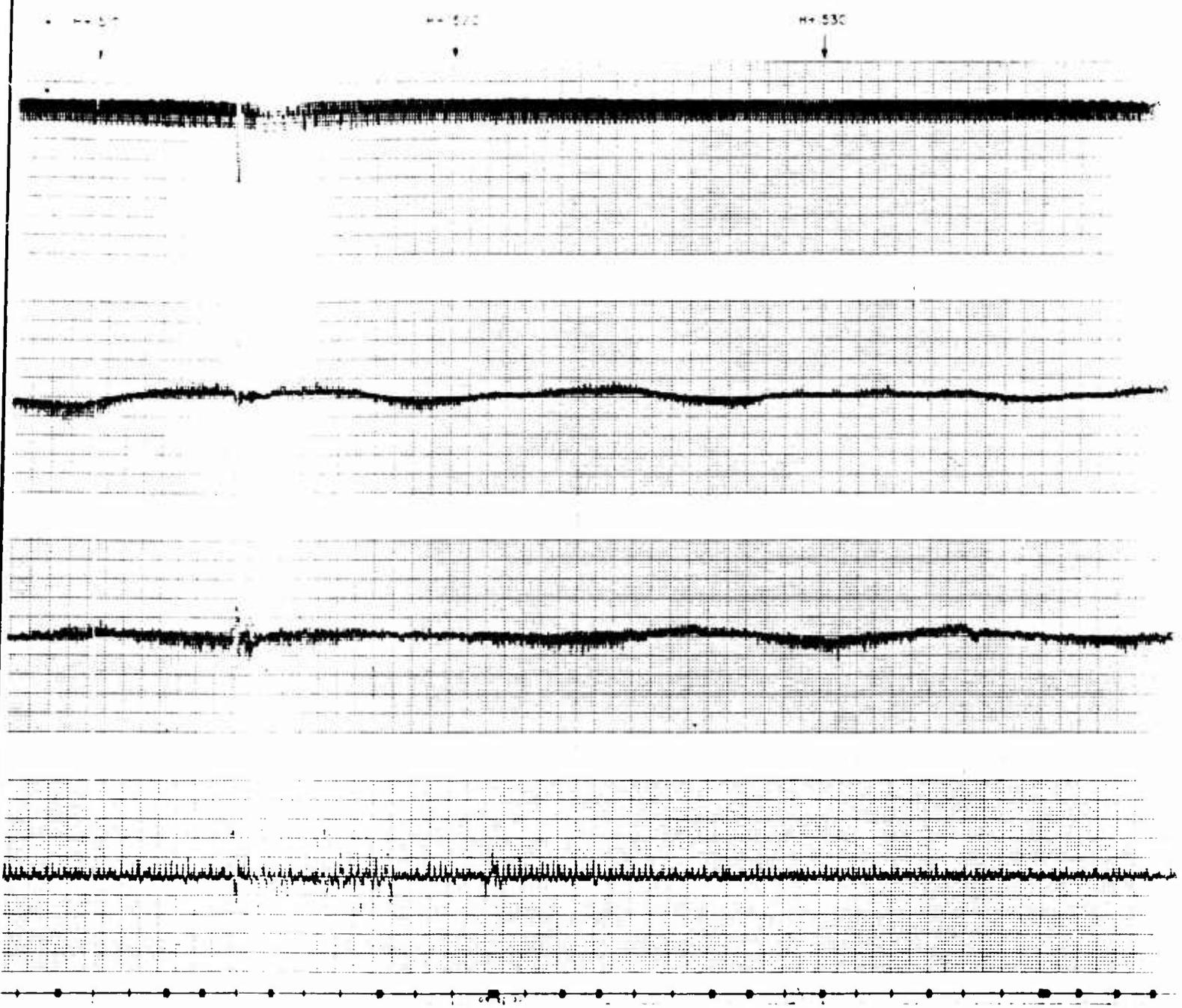
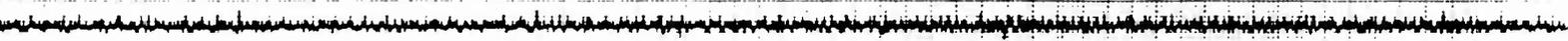
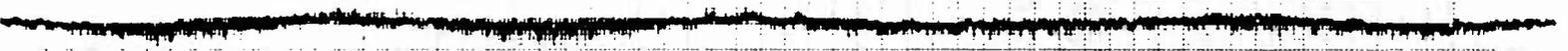
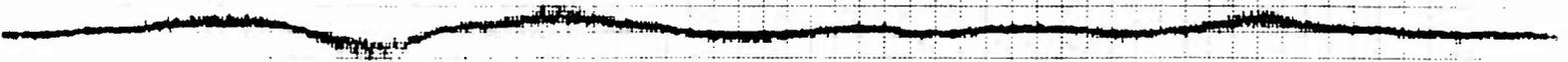
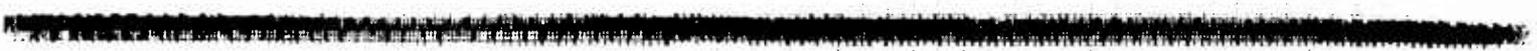


Figure B.5 Continued.

H+ 560

H+ 560



H+ 550



(continued)

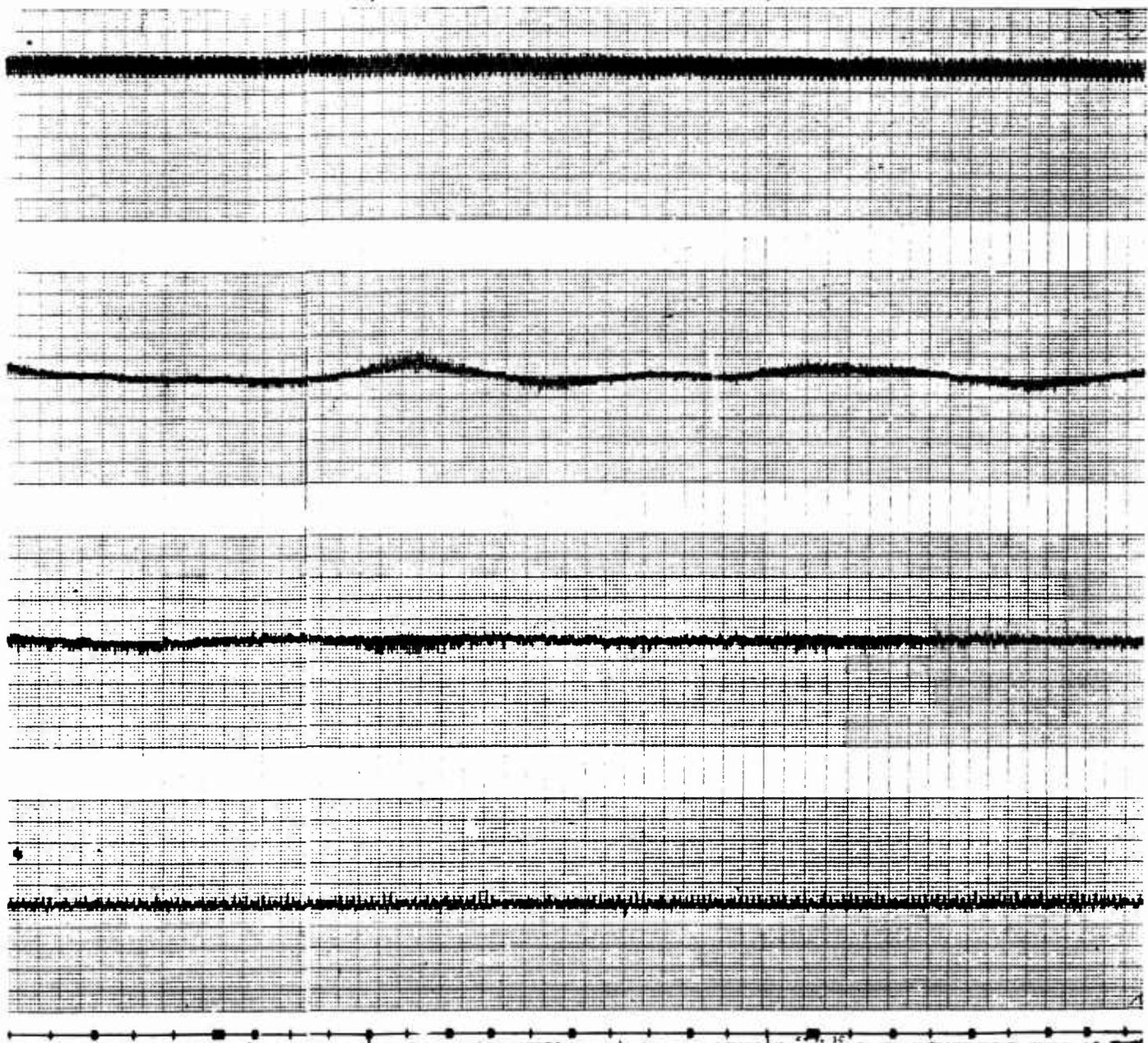
3 .

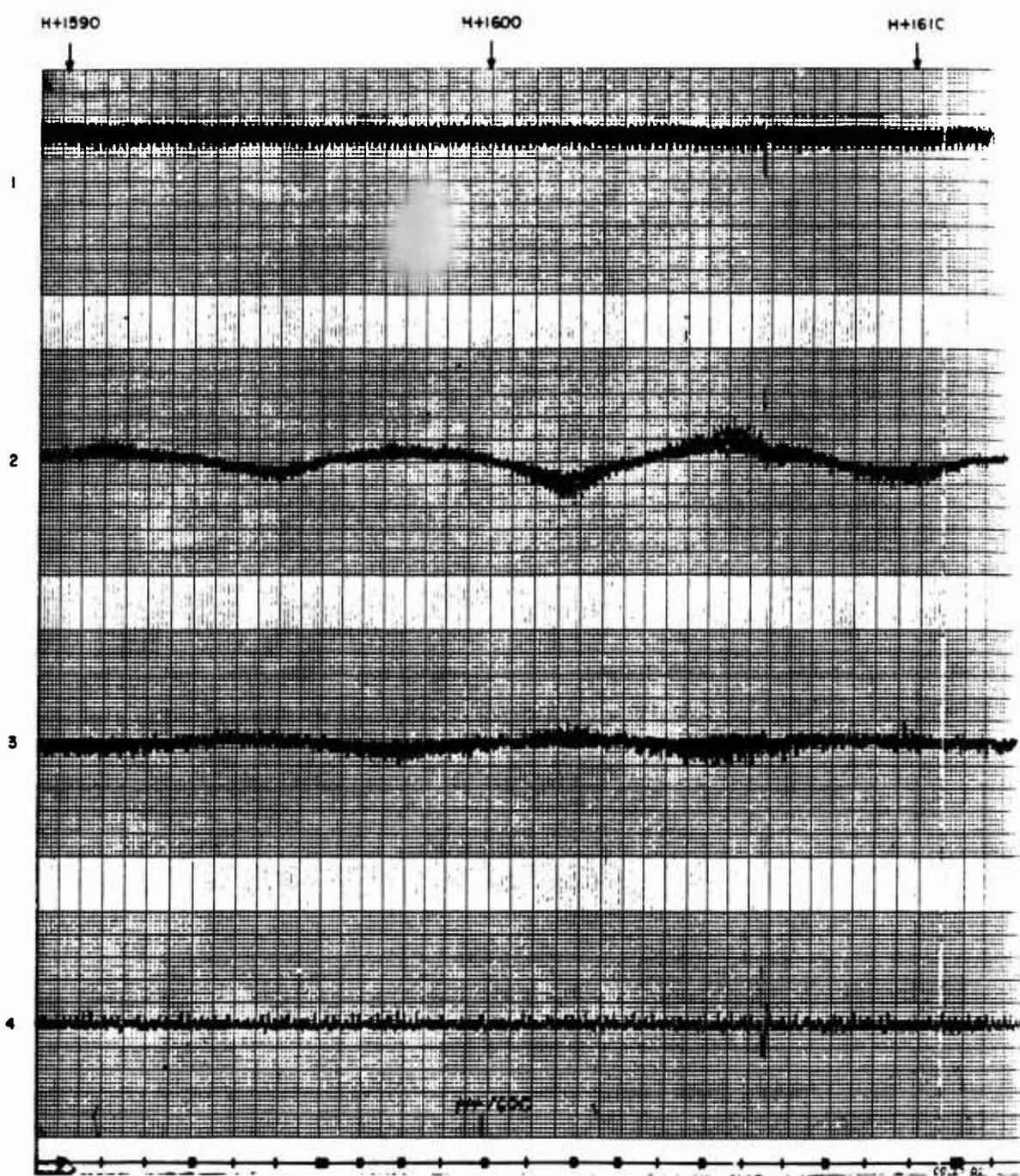
RET

143-3

H+1570

H+1580





- 1- AGC
- 2- AZ ERROR
- 3- EL ERROR
- 4- RANGE ERROR

144-1



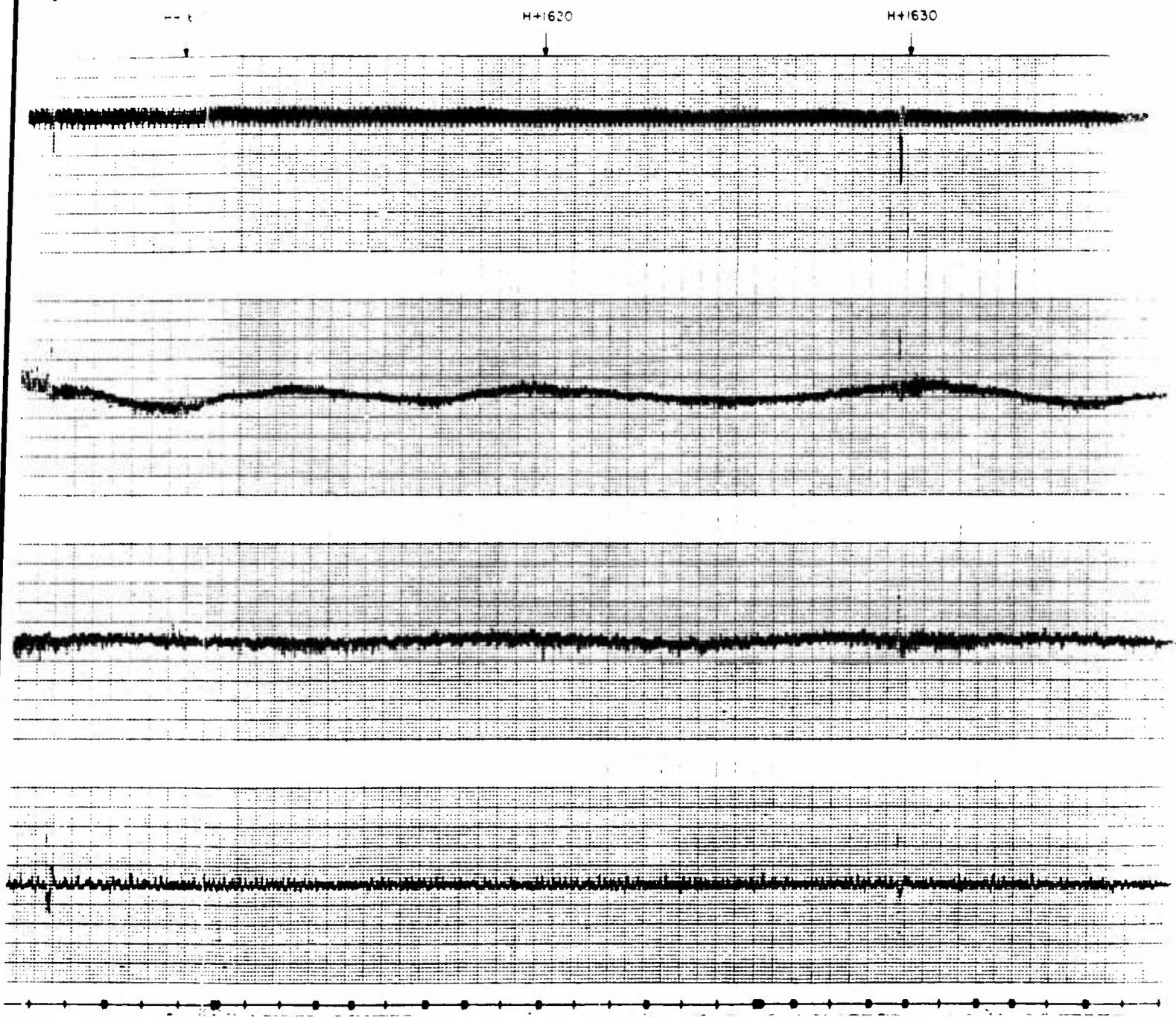
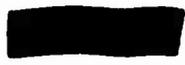


Figure B.5 Conti:



M+650

M+650

M+650

!

!

!



M+650



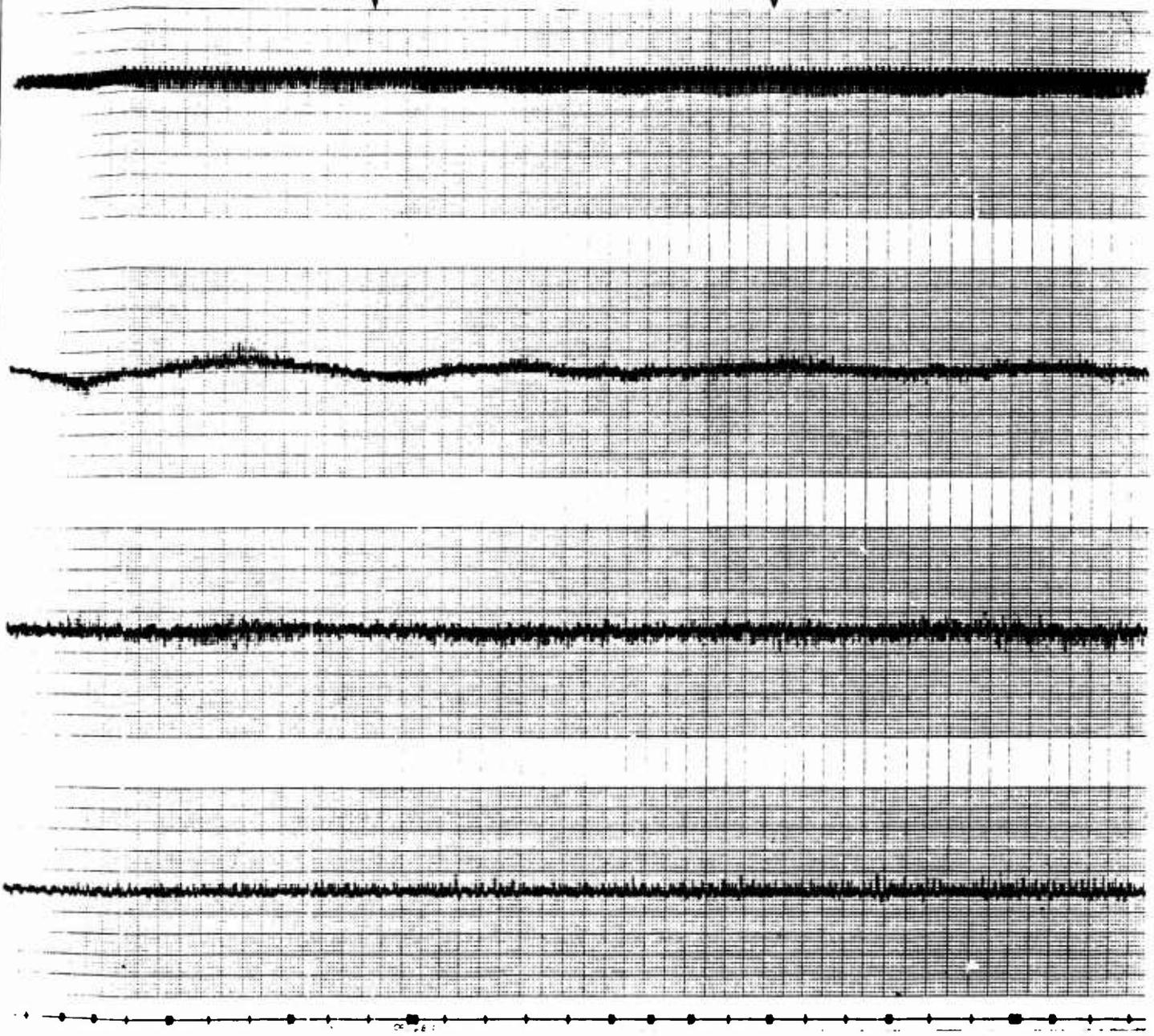
Figure B.5 Continue

14:3



H+1670

H+1680



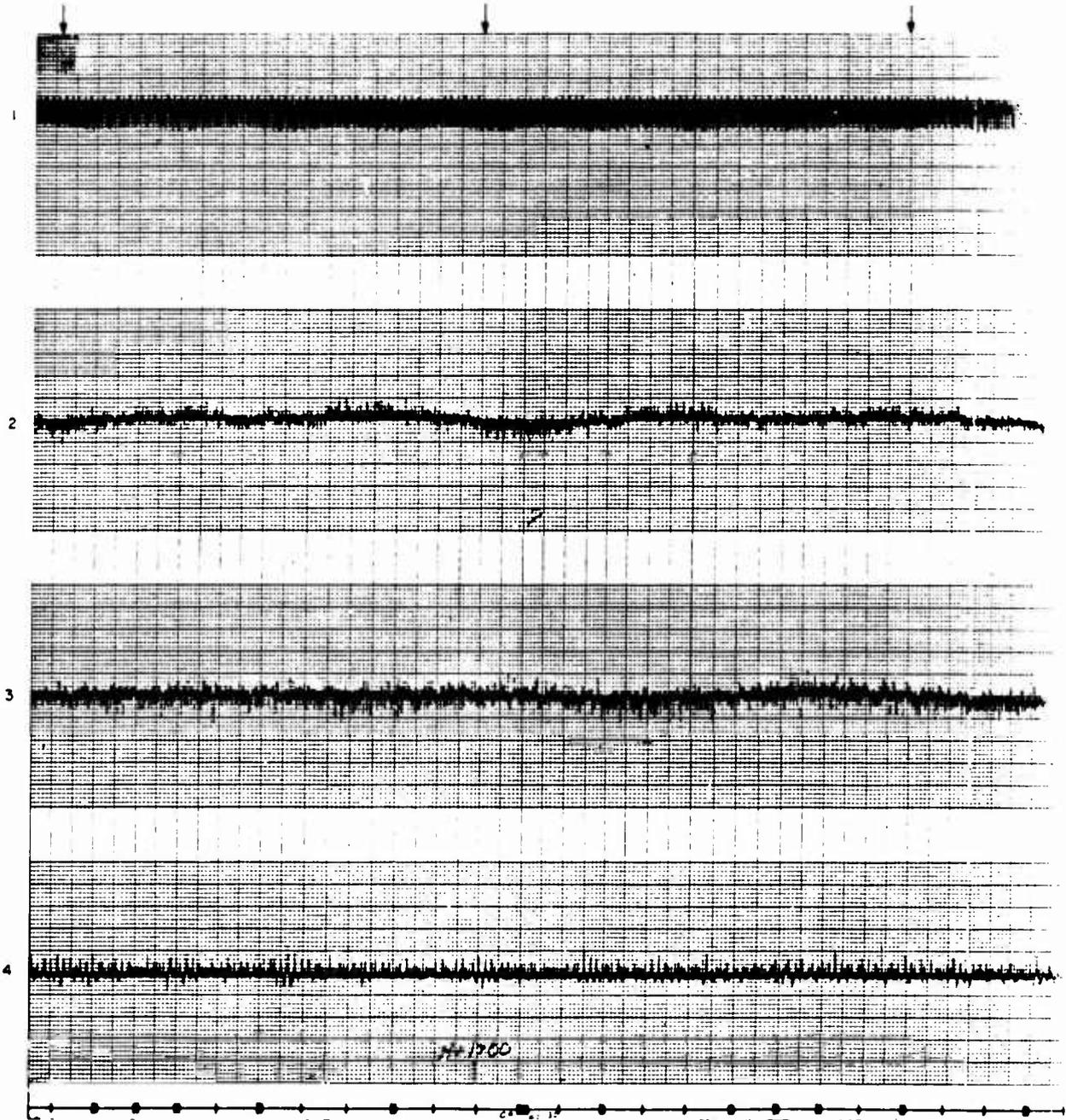
144-4



H+1690

H+1700

H+1710



- 1 - AGC
- 2 - AZ ERROR
- 3 - EL ERROR
- 4 - RANGE ERROR

145-1

H+720

H+1730

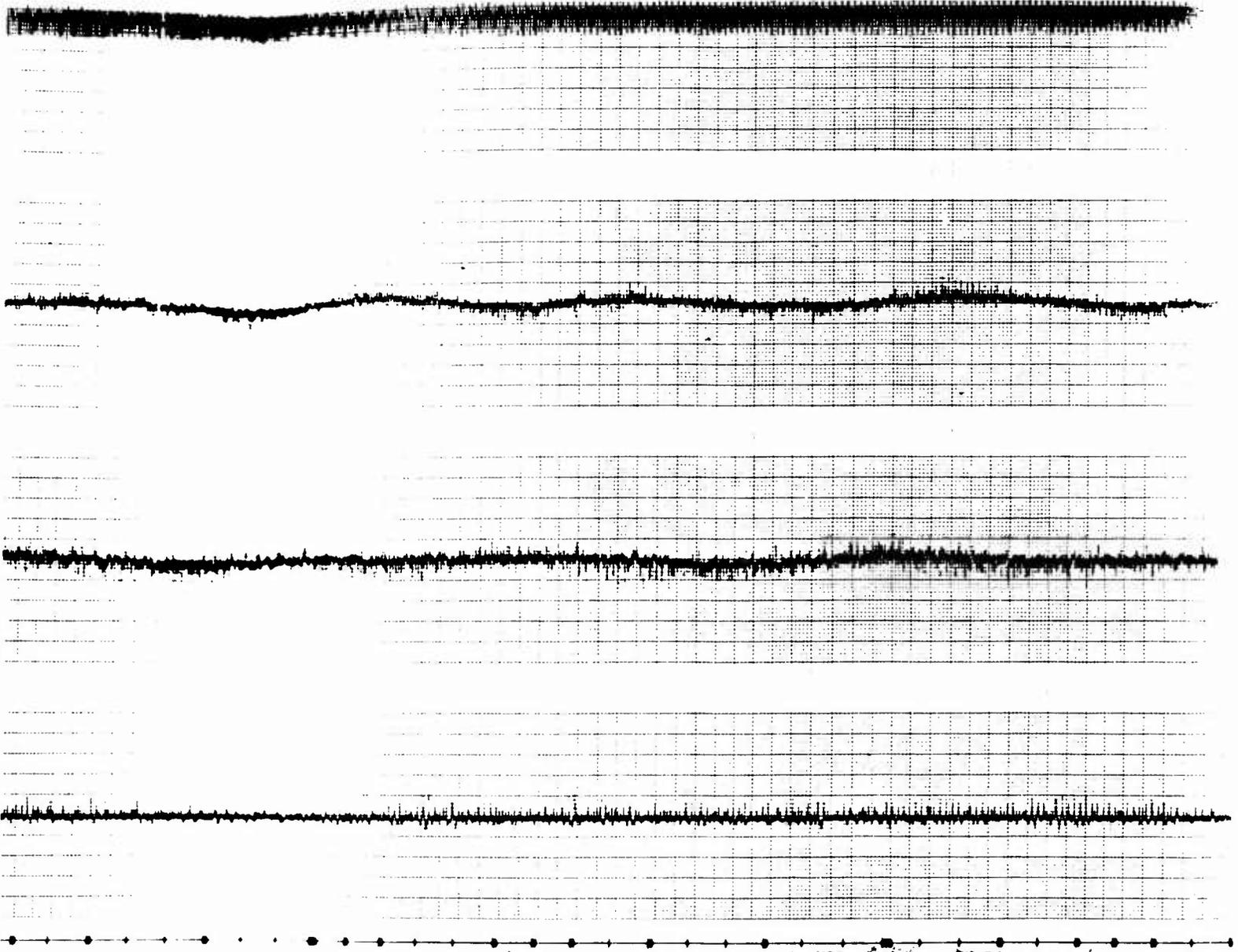


Figure B.5 Continued.

145 - 2

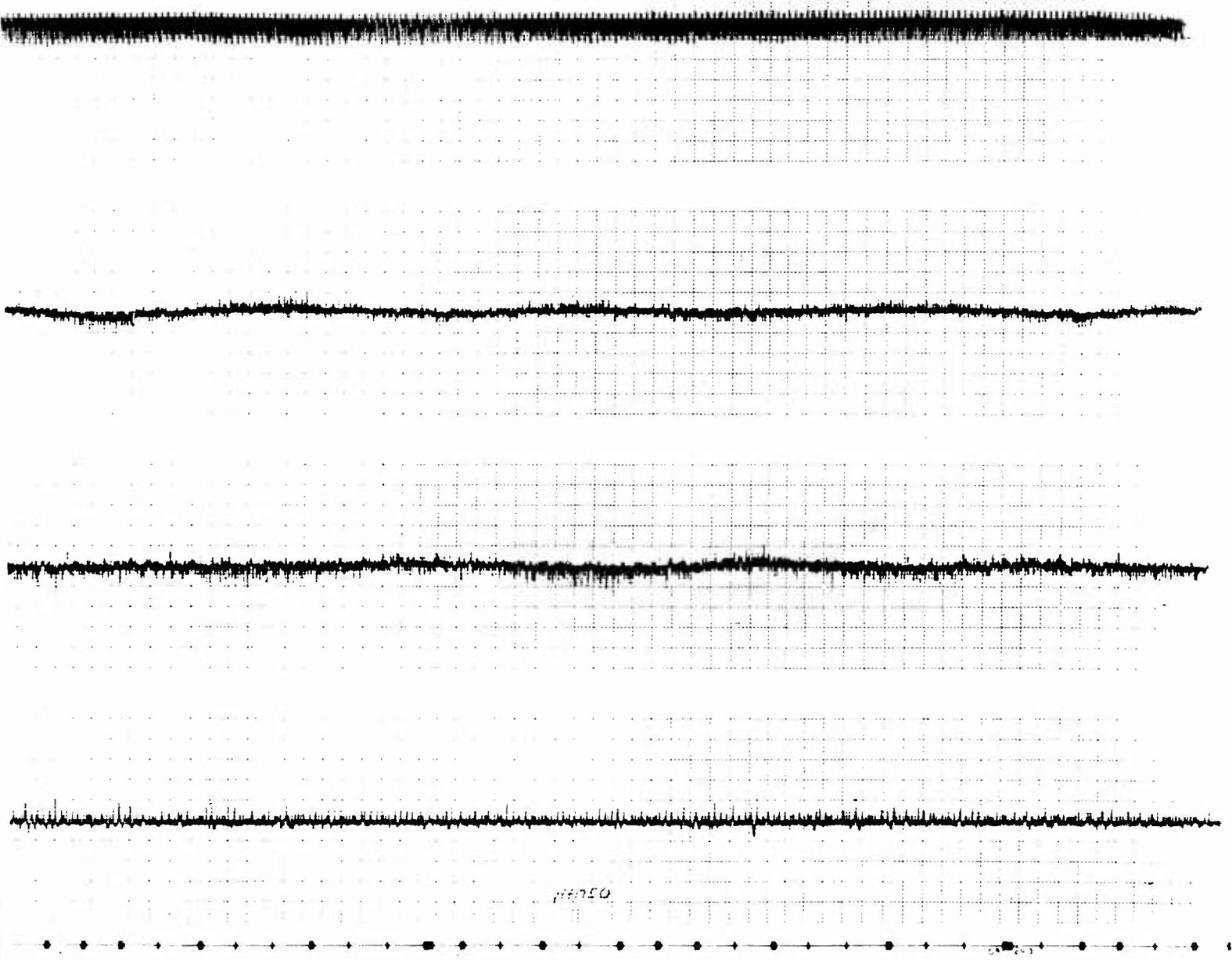


1001 - 2

H+1760

H+1760

H+1760

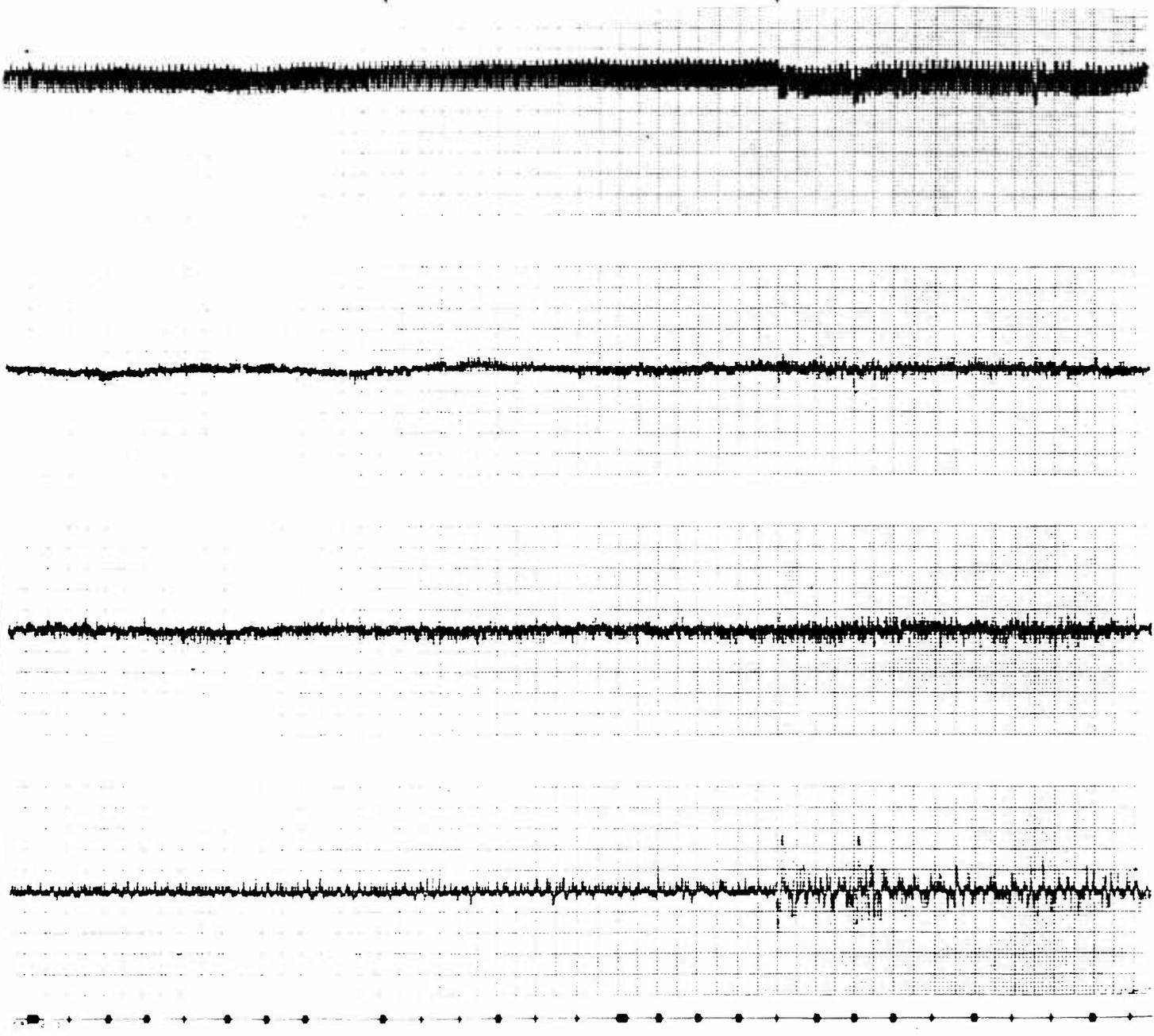


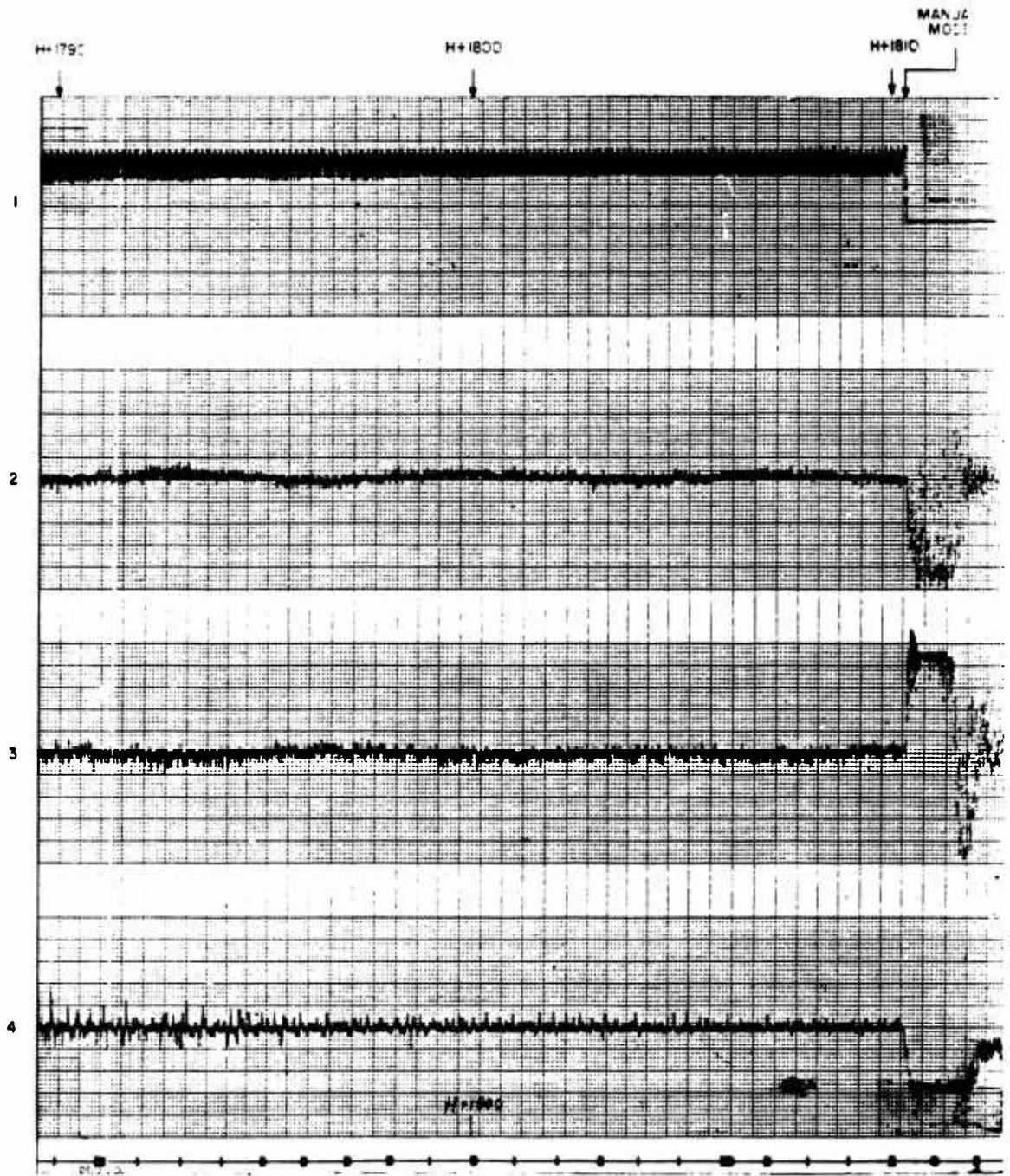
Continued

5
RET

4-3

H-780

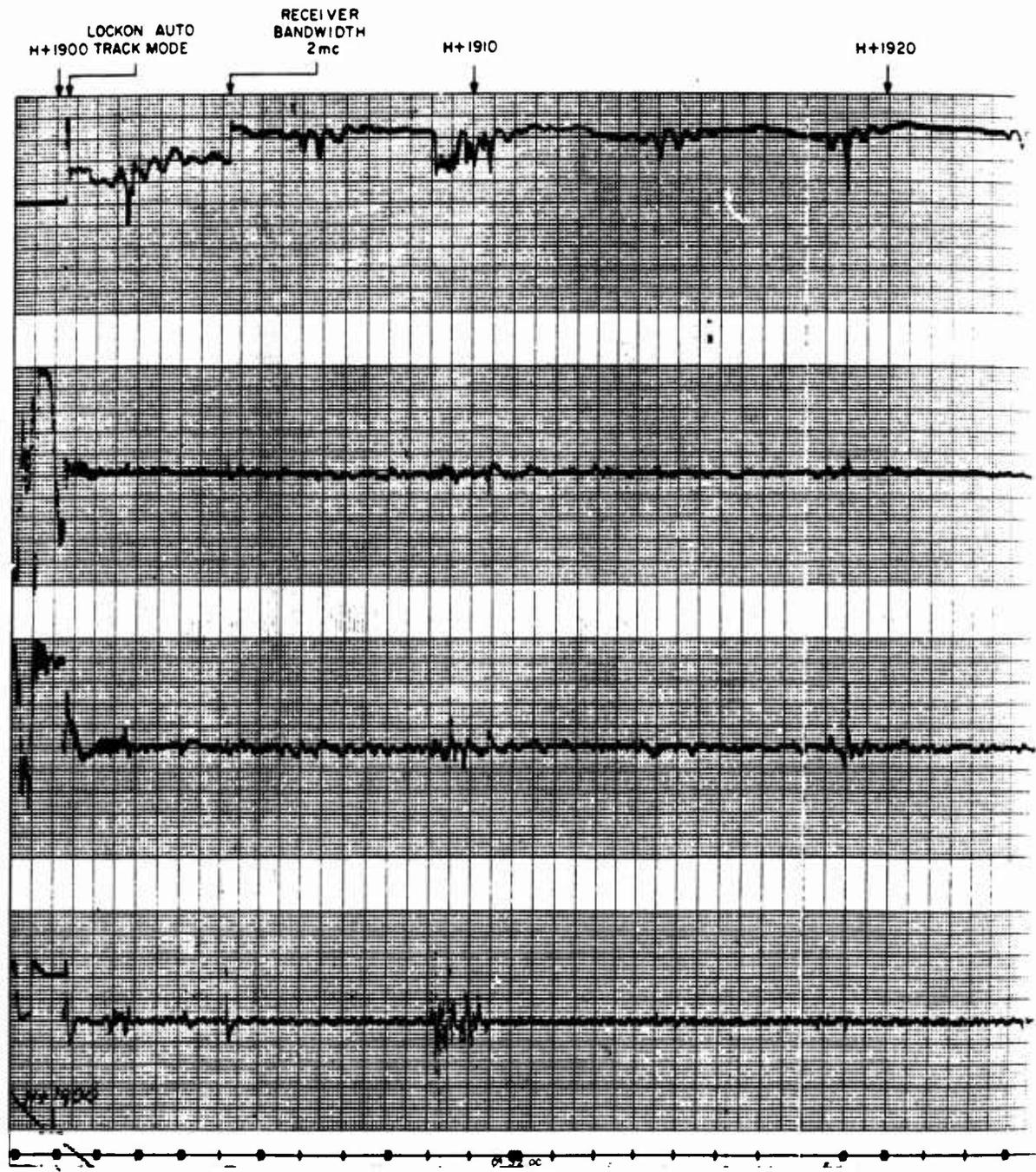




- 1- AGC
- 2- AZ ERROR
- 3- EL ERROR
- 4- RANGE ERROR

Figure B.5 Continued.





- 1-AGC
- 2-AZ ERROR
- 3-EL ERROR
- 4-RANGE ERROR

147-1

H+ 930

H+ 930

H+ 940

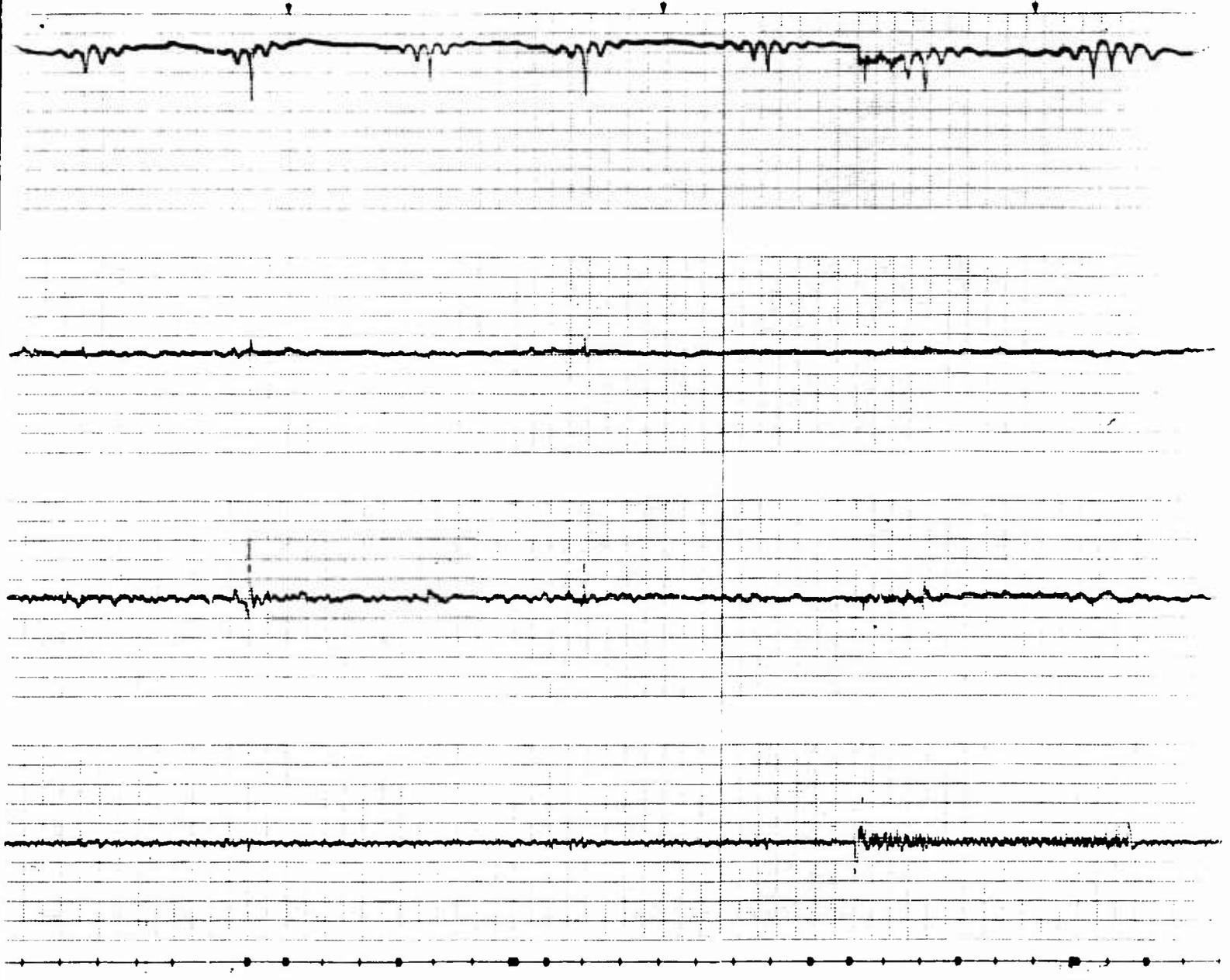
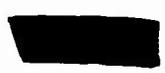


Figure B.6 Trac.



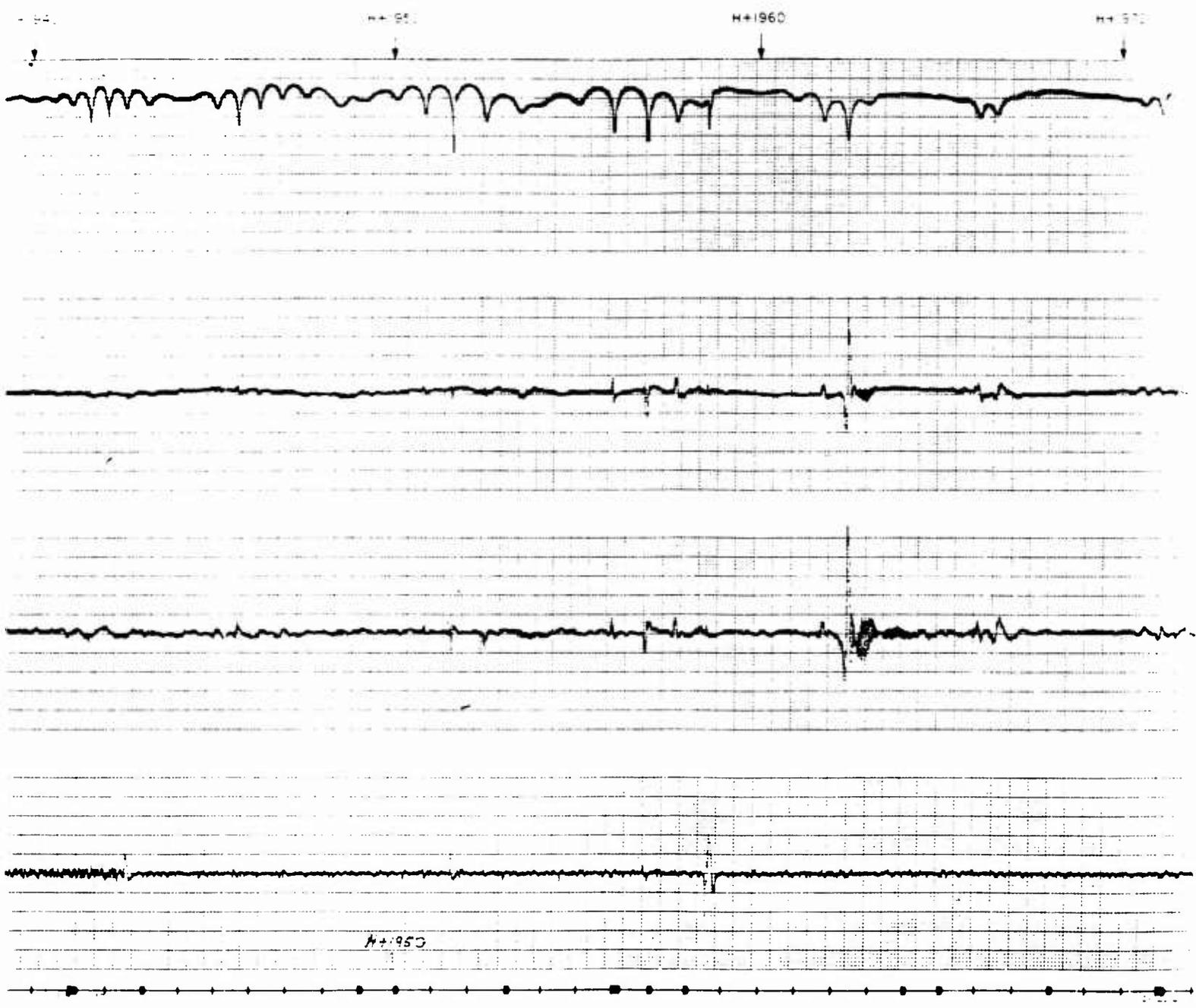
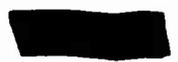
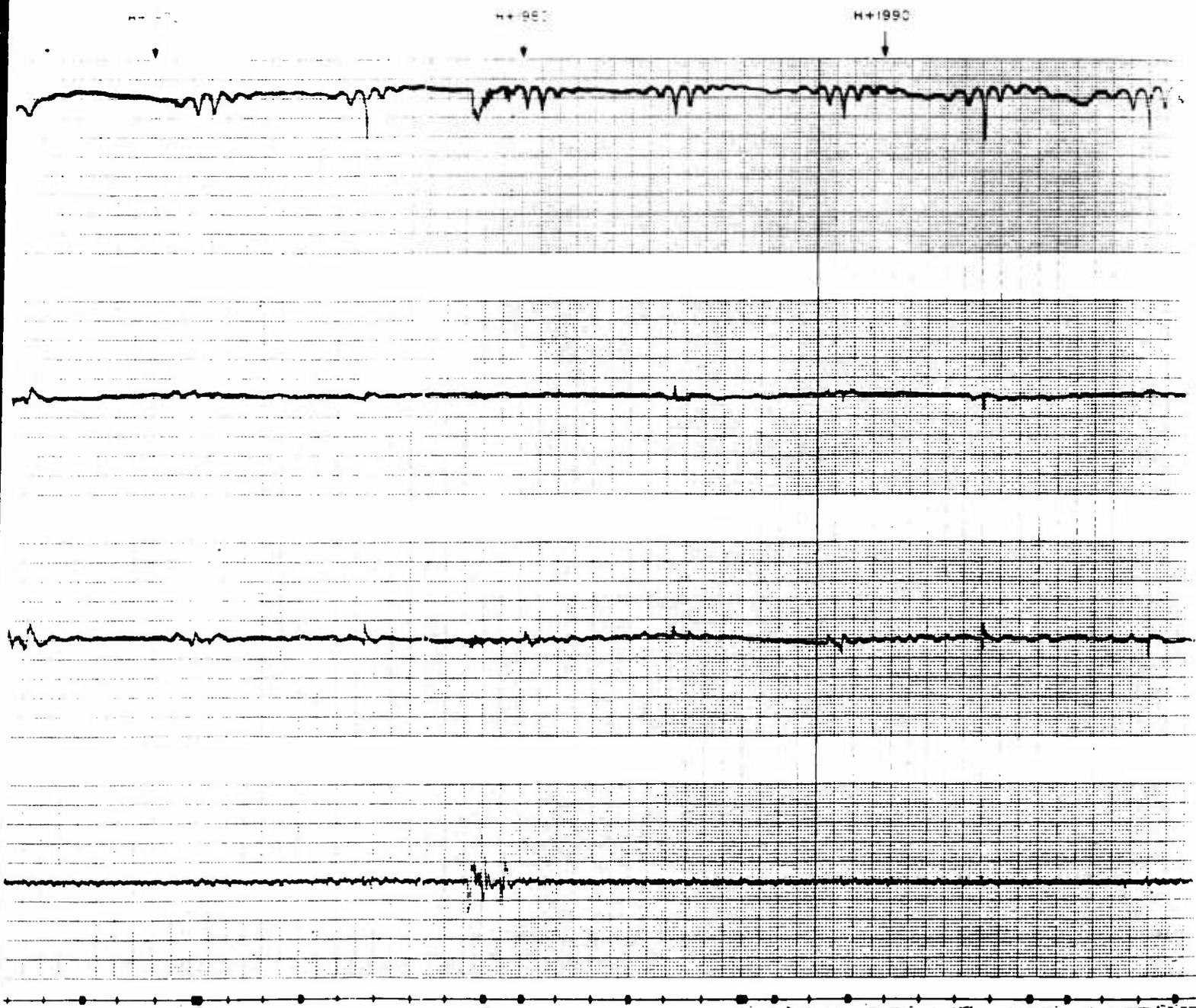


Figure B.6 Track, Probe 6.

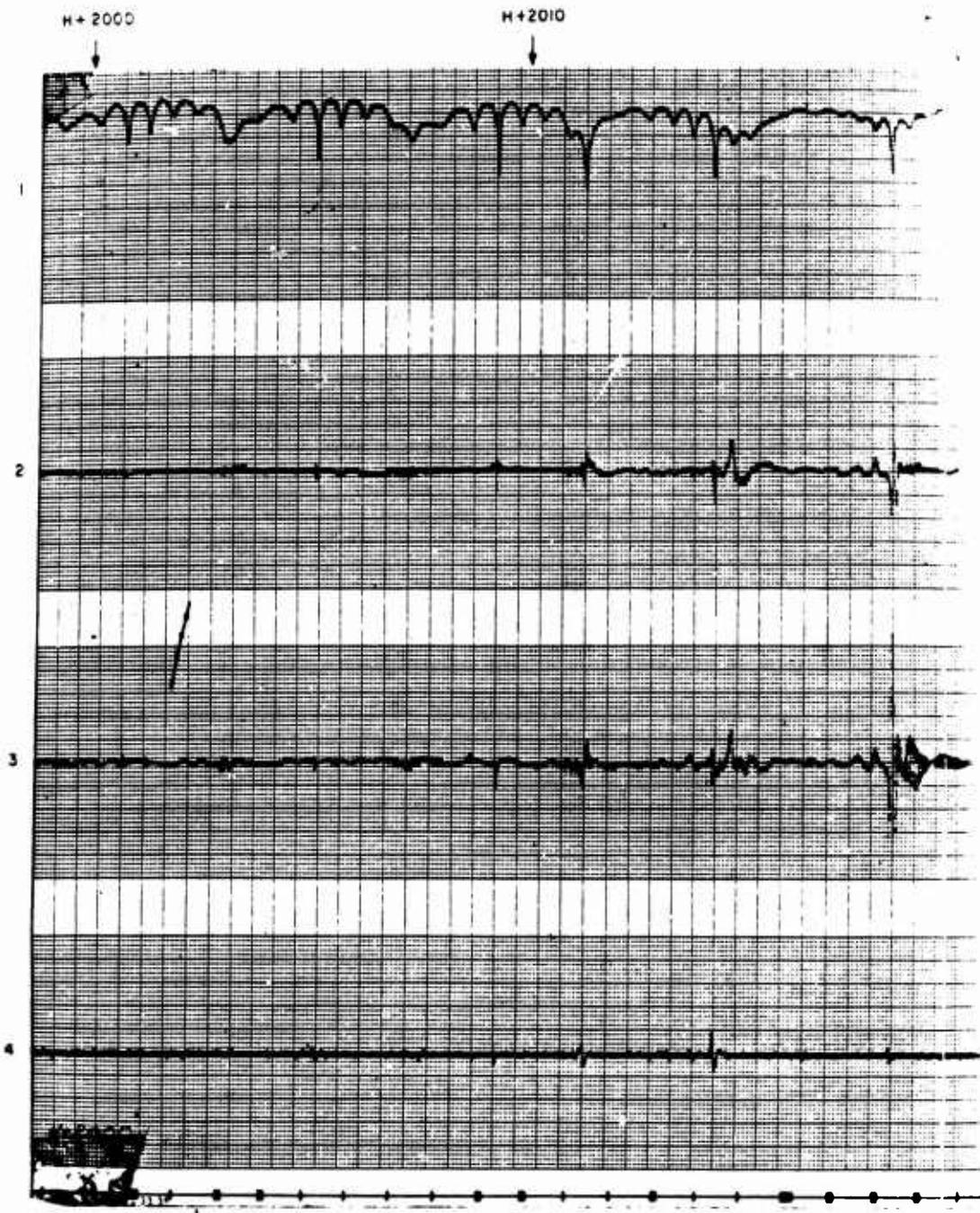
147-3





147-4





H - 200

H - 2035

H - 2040

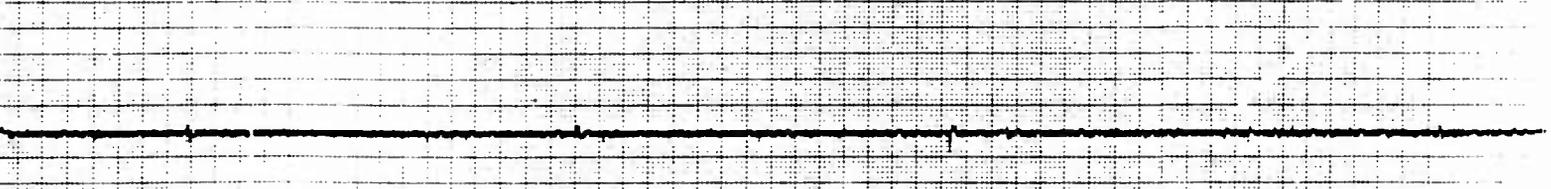
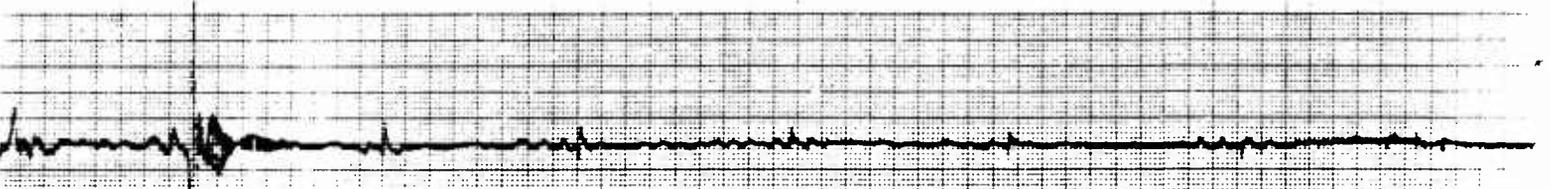
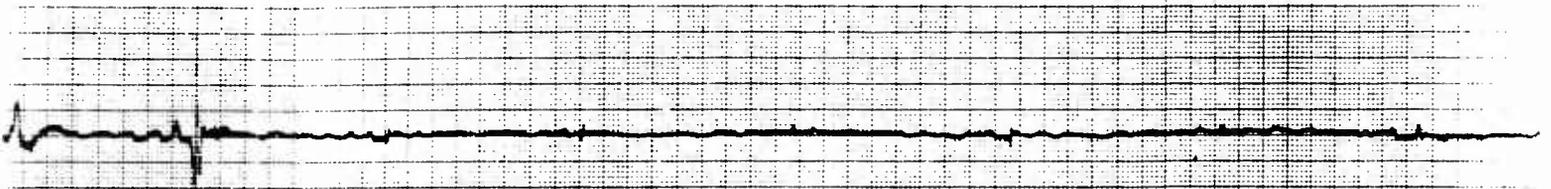


Figure B.6 Cont.

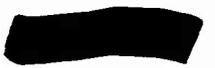


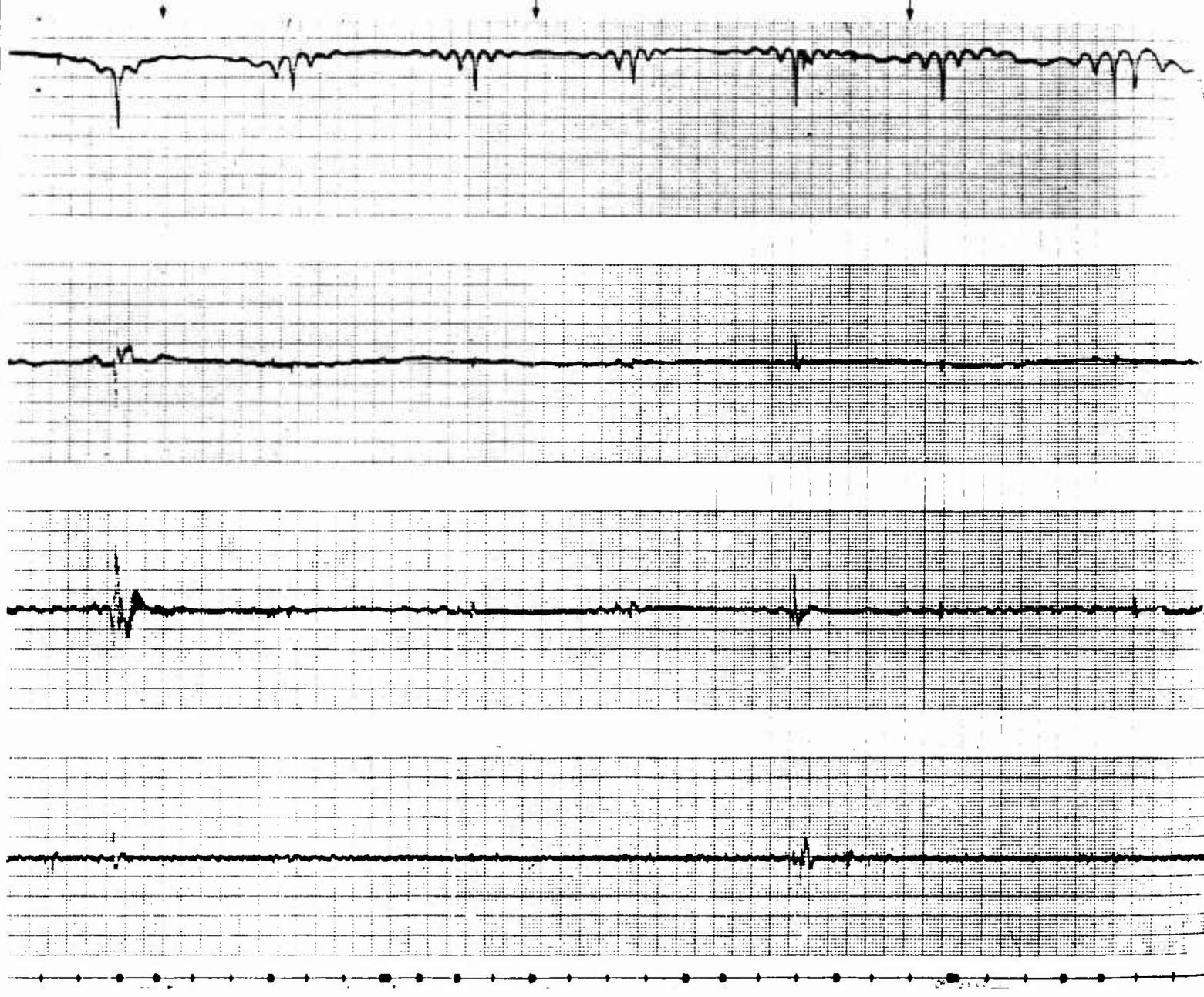


Figure B.6 Continued.

H + 207

H + 2080

H + 2090



148-4



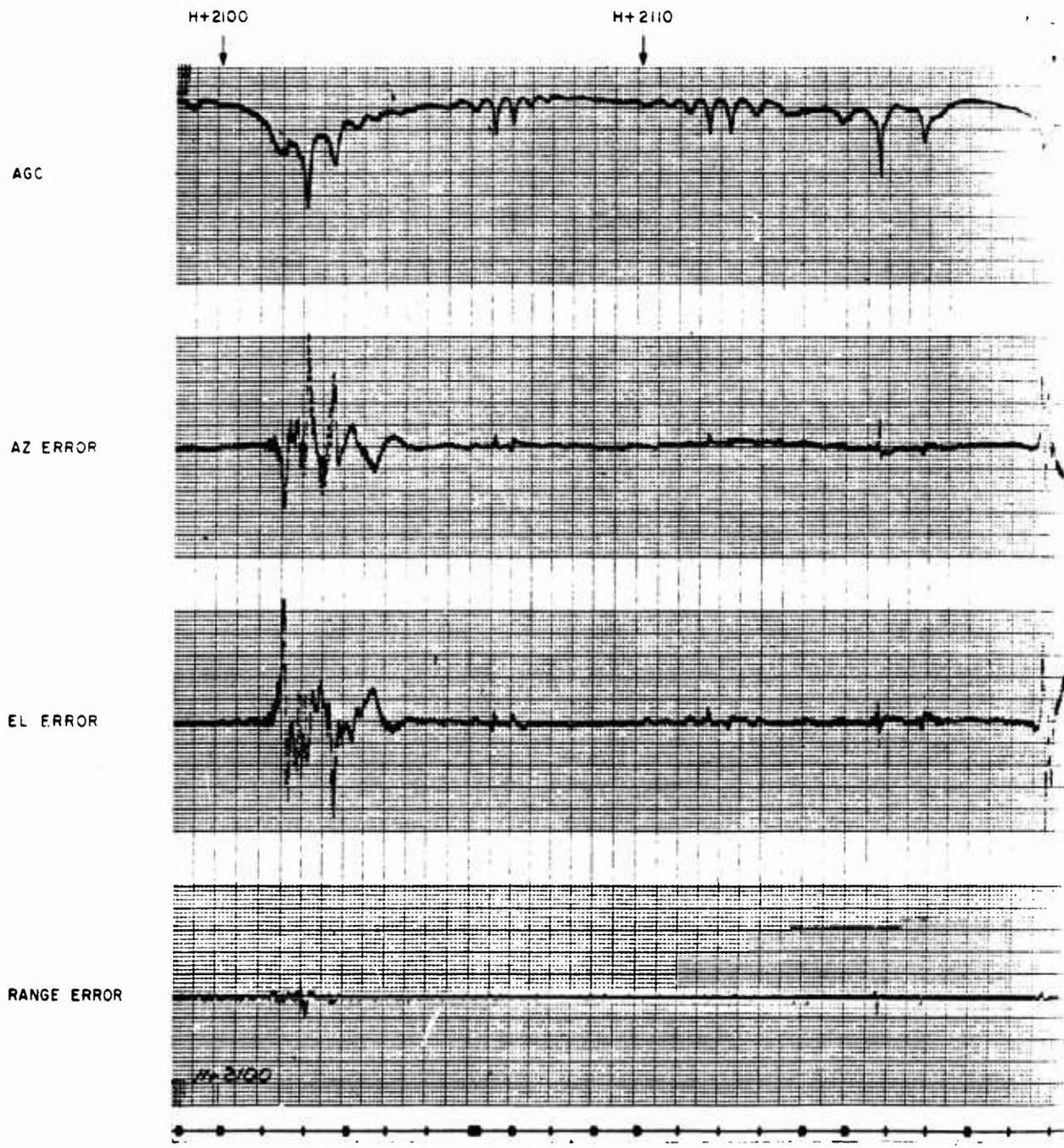


Figure B.6

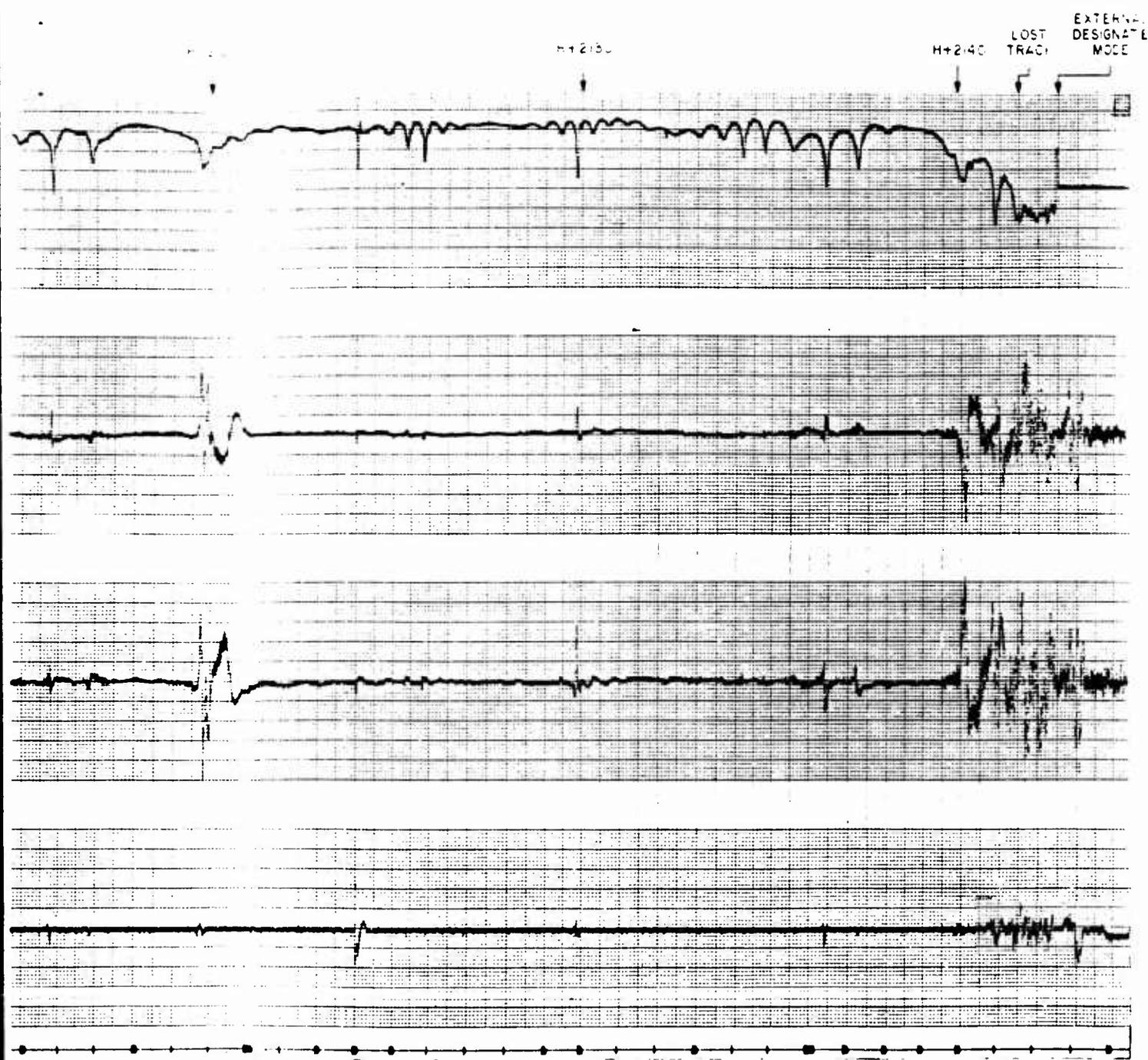
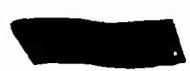


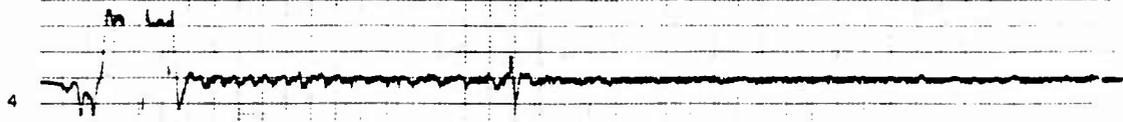
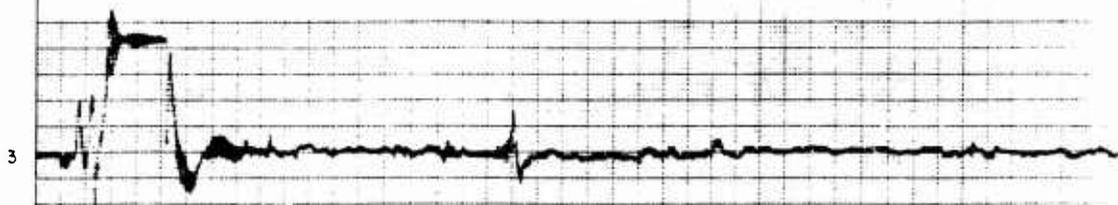
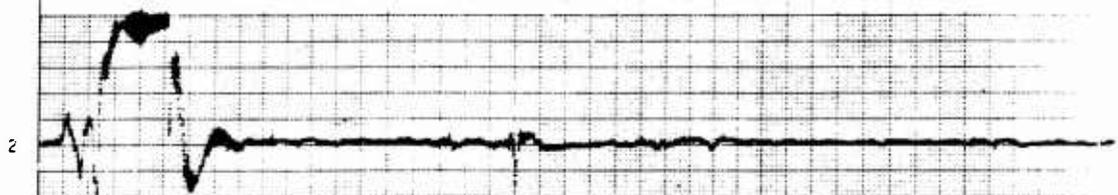
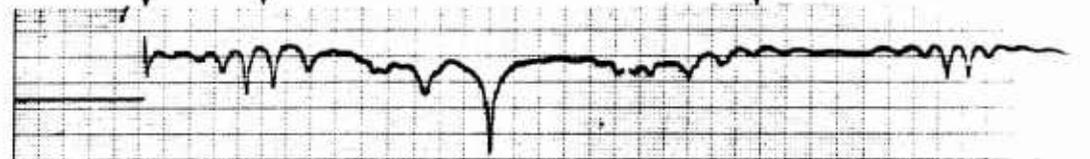
Figure E.6 Continued.

149-2



LOCKON-AUTO
TRACK MODE H+2 90

H+2200



H+2200

- 1- AGC
- 2- AZ ERROR
- 3- EL ERROR
- 4- RANGE ERROR

150-1

H+2210

H+2220

H+2230

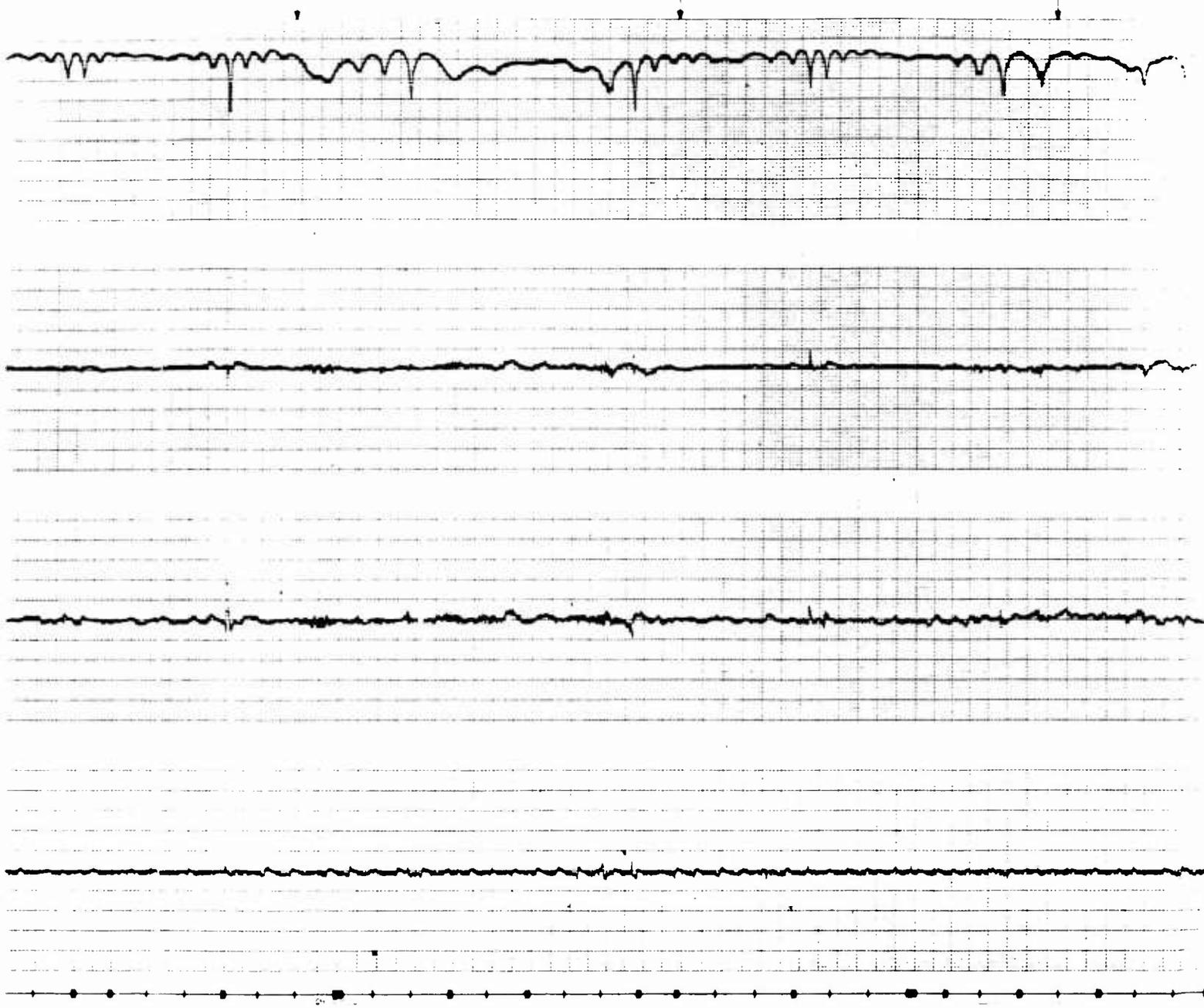
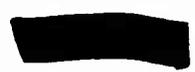


Figure B.6 Continued.



H+2230

H+2240

H+2250



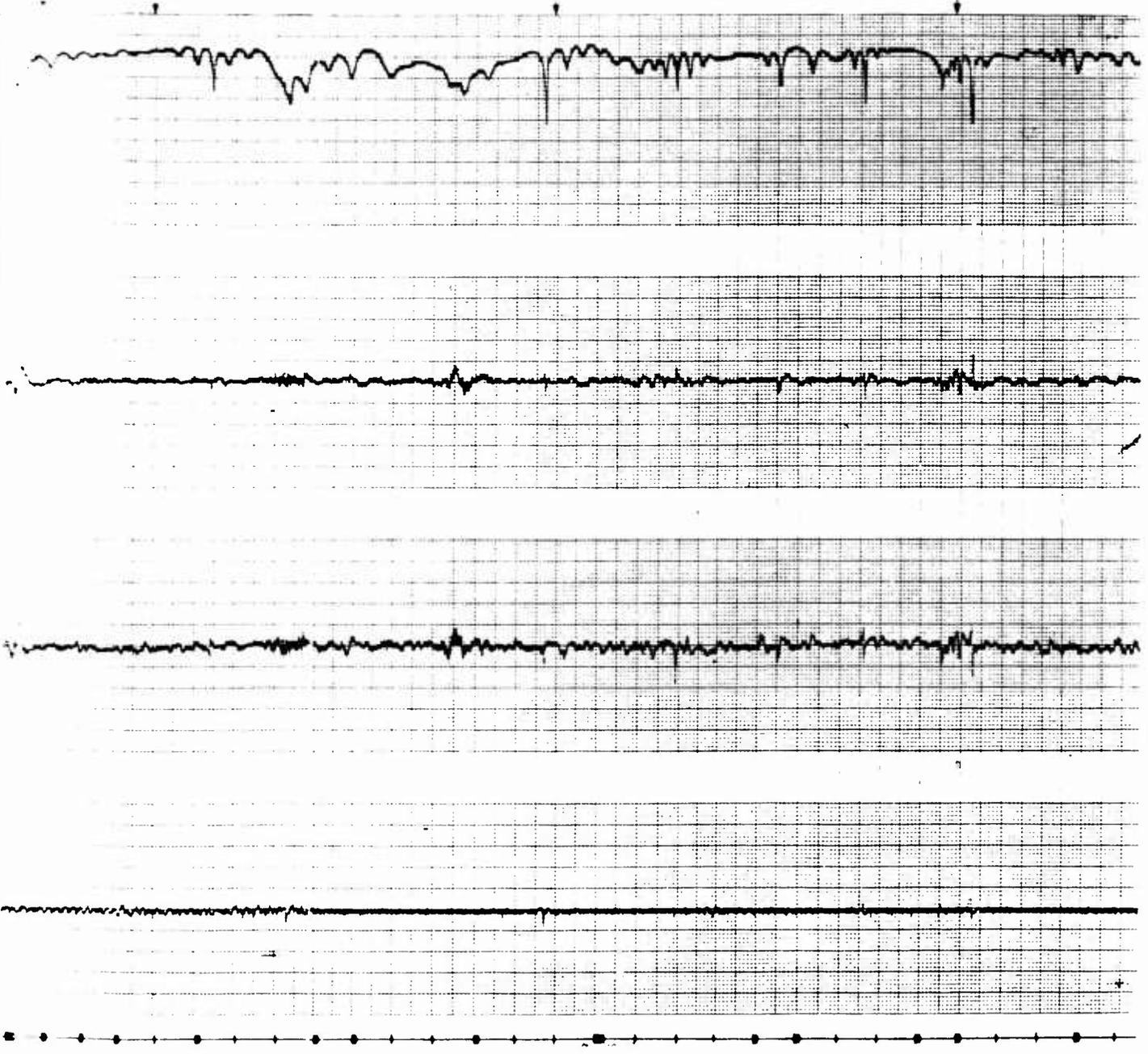
Figure B.6 Continud.



H+2280

H+2270

H+2280



150-4



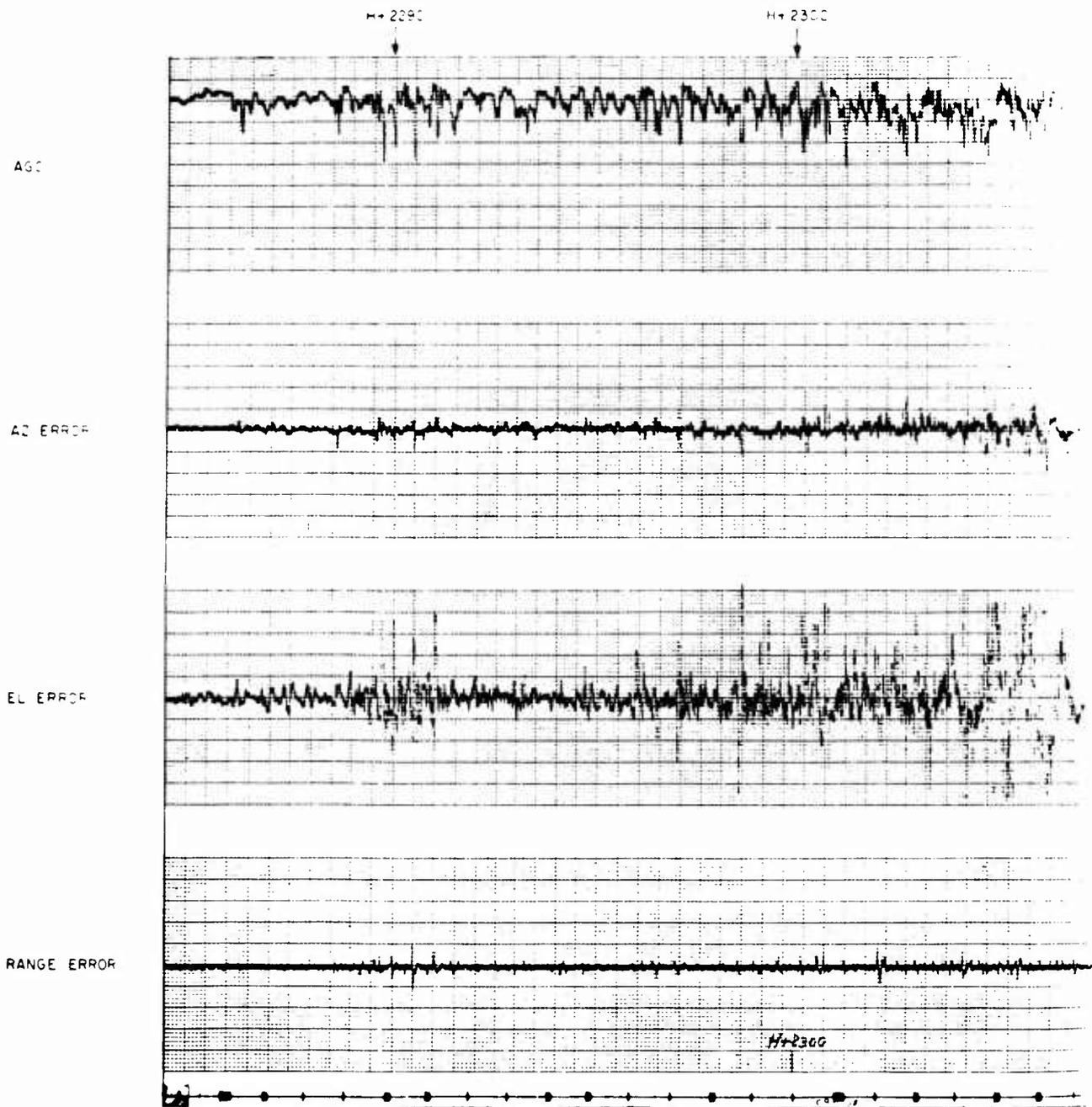
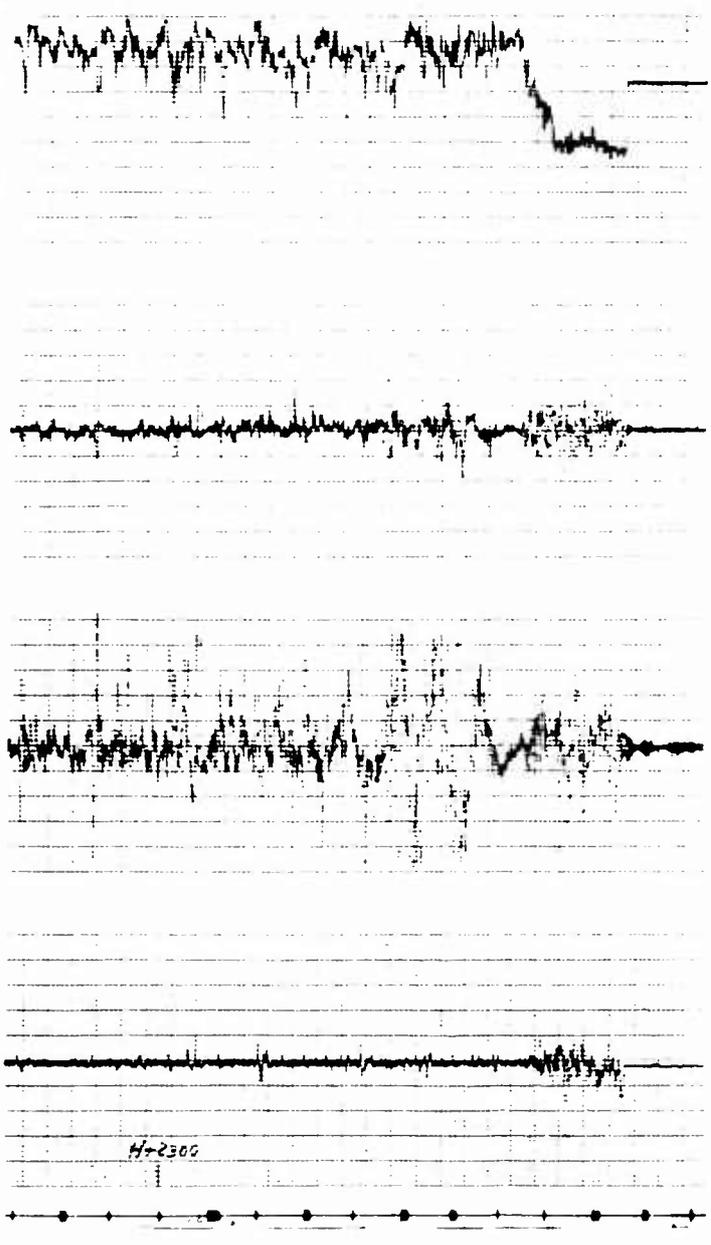


Figure B.6 Continued.

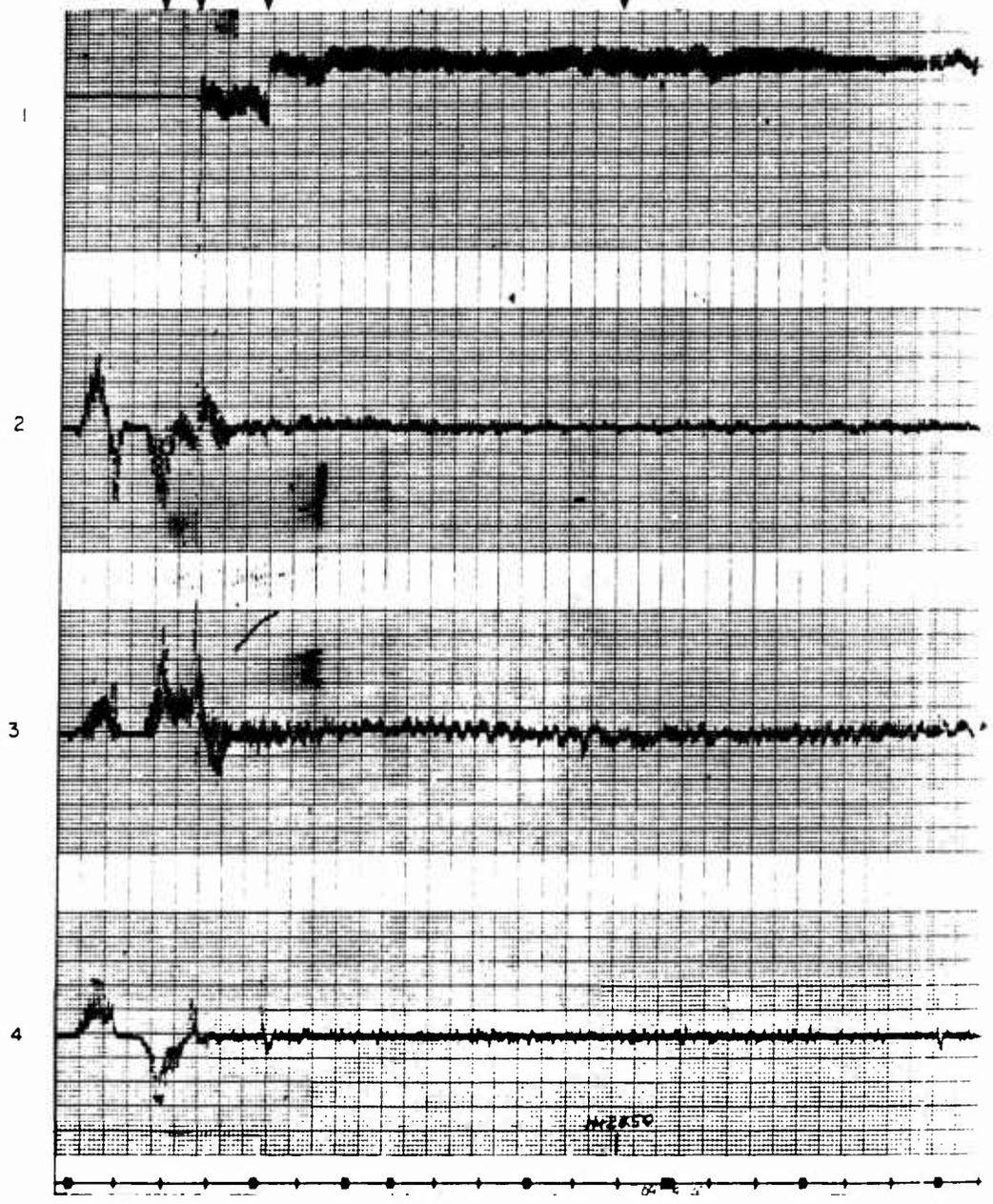
M-100
W-100
100
100



H-2300

continued.

H+244C LOCKON-AUTO TRACK MODE RECEIVER BANDWIDTH 2 mc H+2450



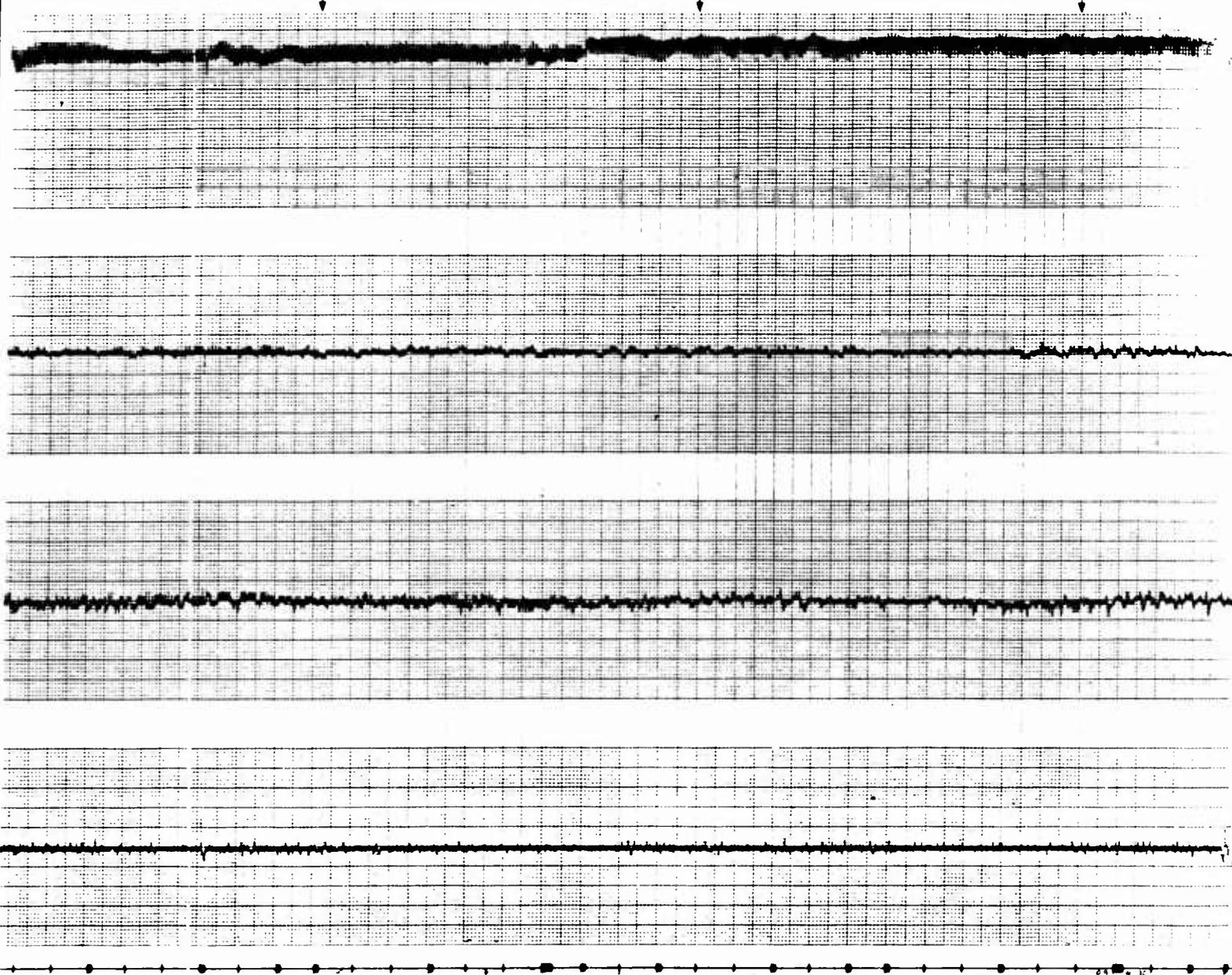
- 1- AGC
- 2- AZ ERROR
- 3- EL ERROR
- 4- RANGE ERROR

152-1

H+2460

H+2470

H+2480



Figure

152-2



H+2480

H+2490

H+2500

H+2510

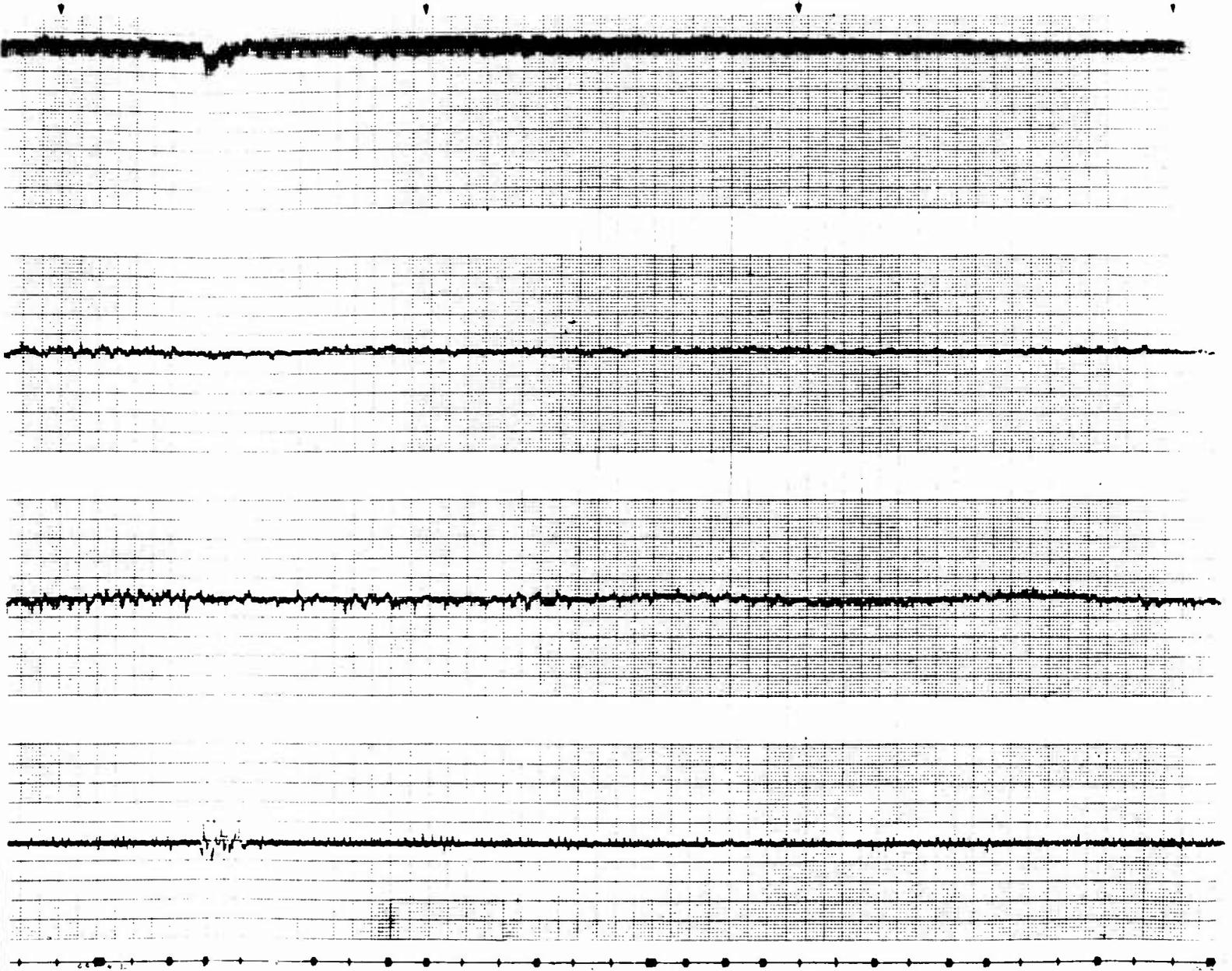


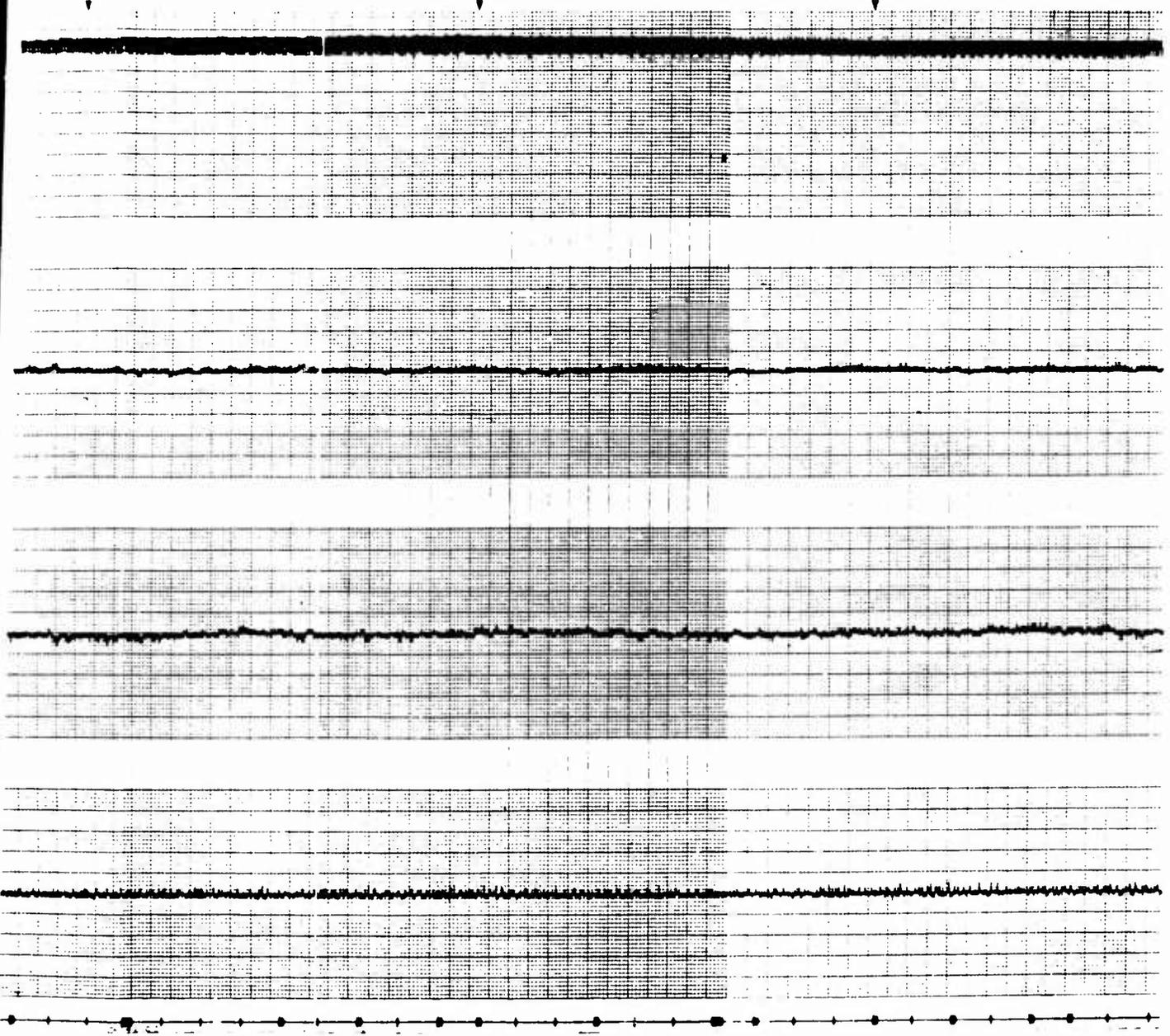
Figure B.7 Track, Probe 7.

152 - 3



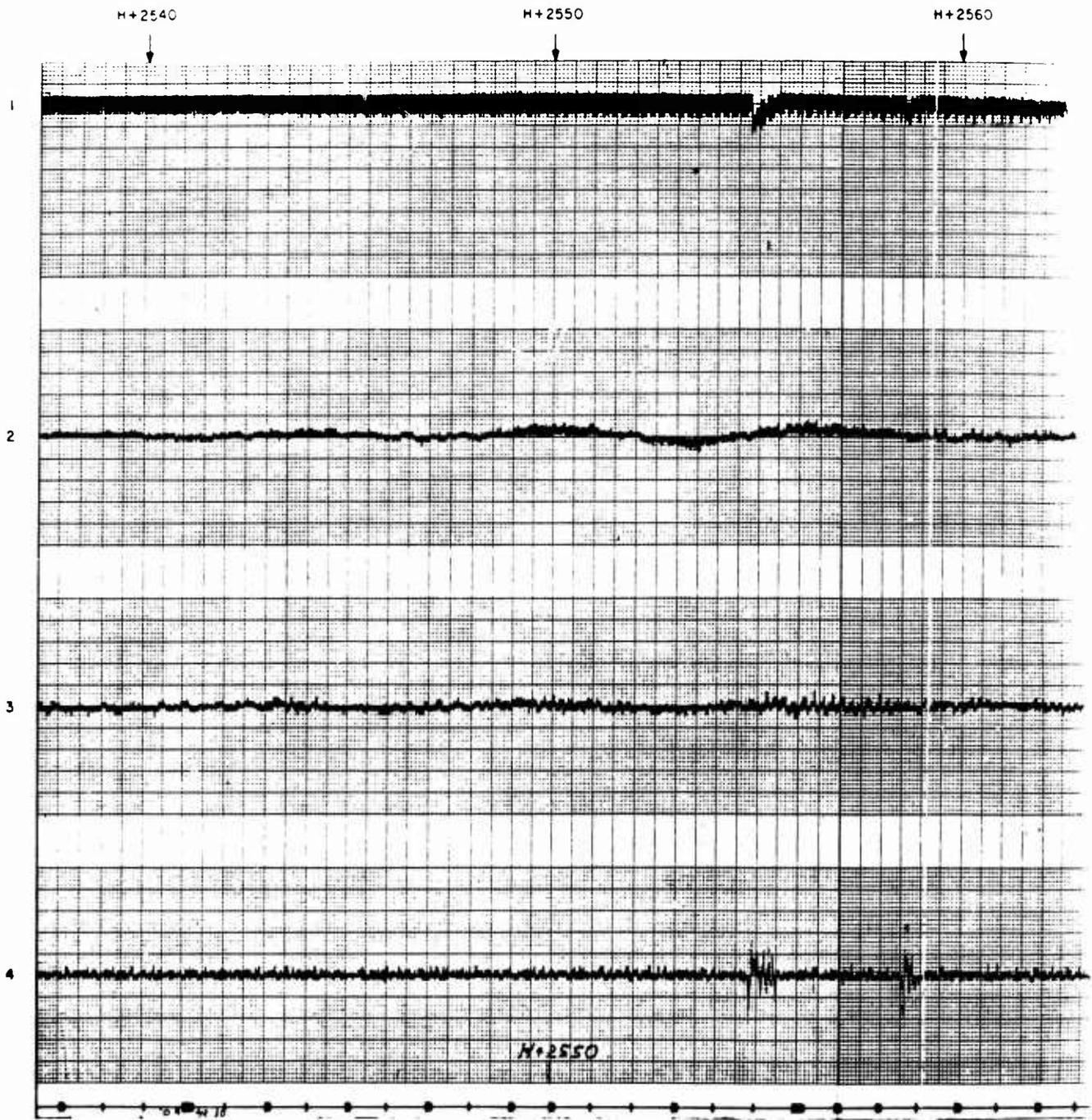
H+2520

H+2530



152-4





- 1 - AGC
- 2 - AZ ERROR
- 3 - EL ERROR
- 4 - RANGE ERROR

153-1



m=25c

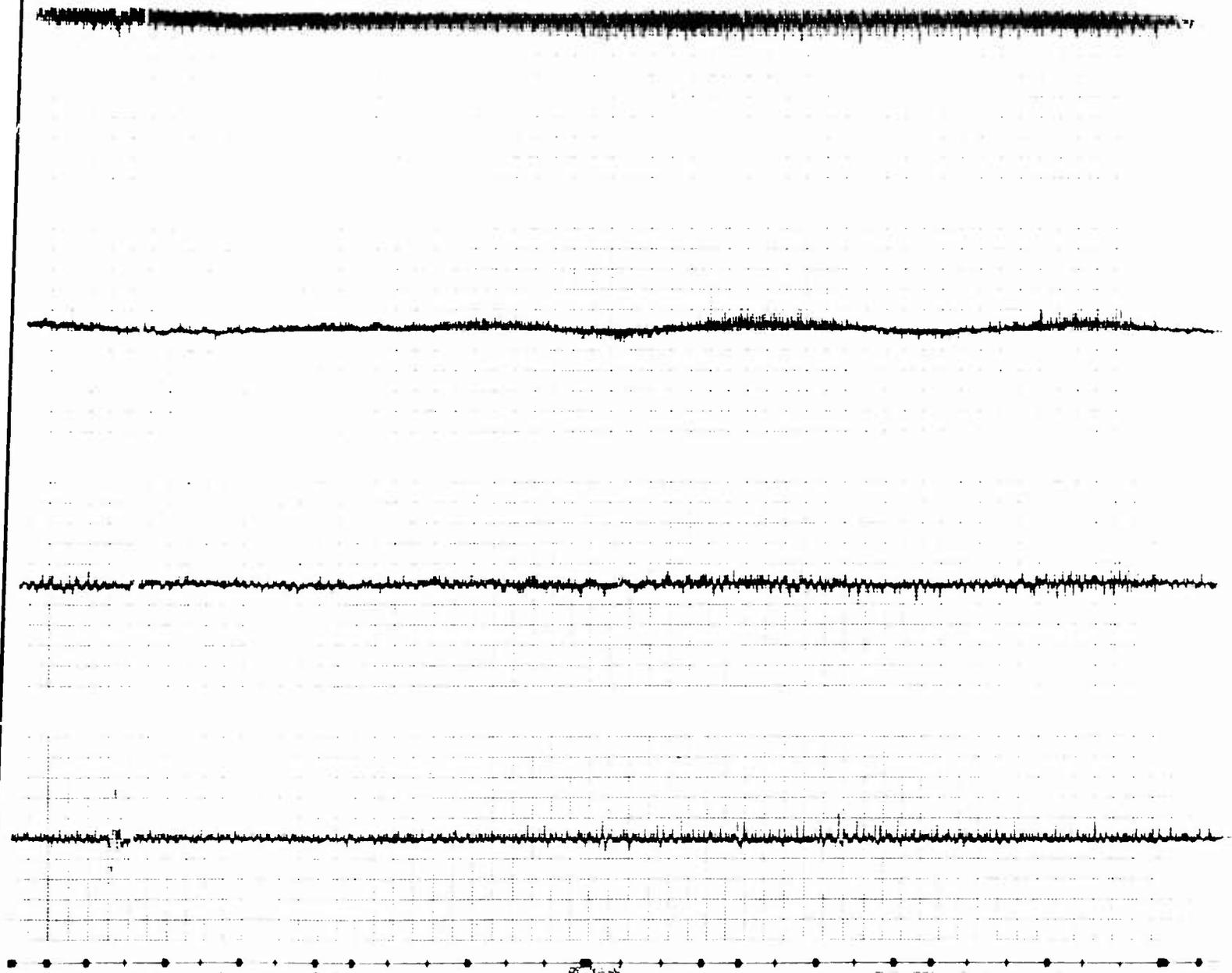
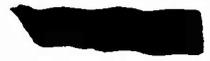
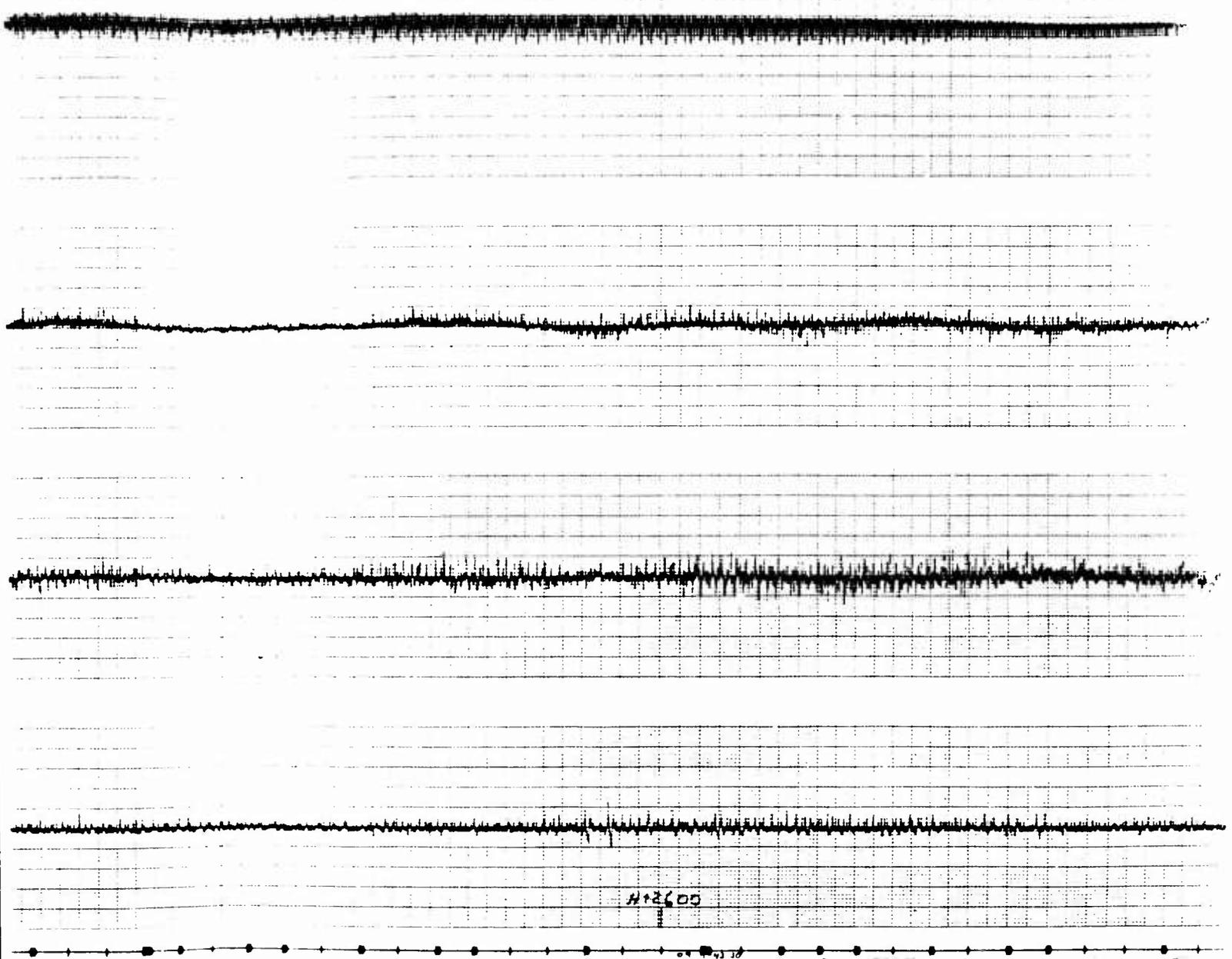


Figure B.7 - Continues



H-2600

H-2600



3.7 Continued.

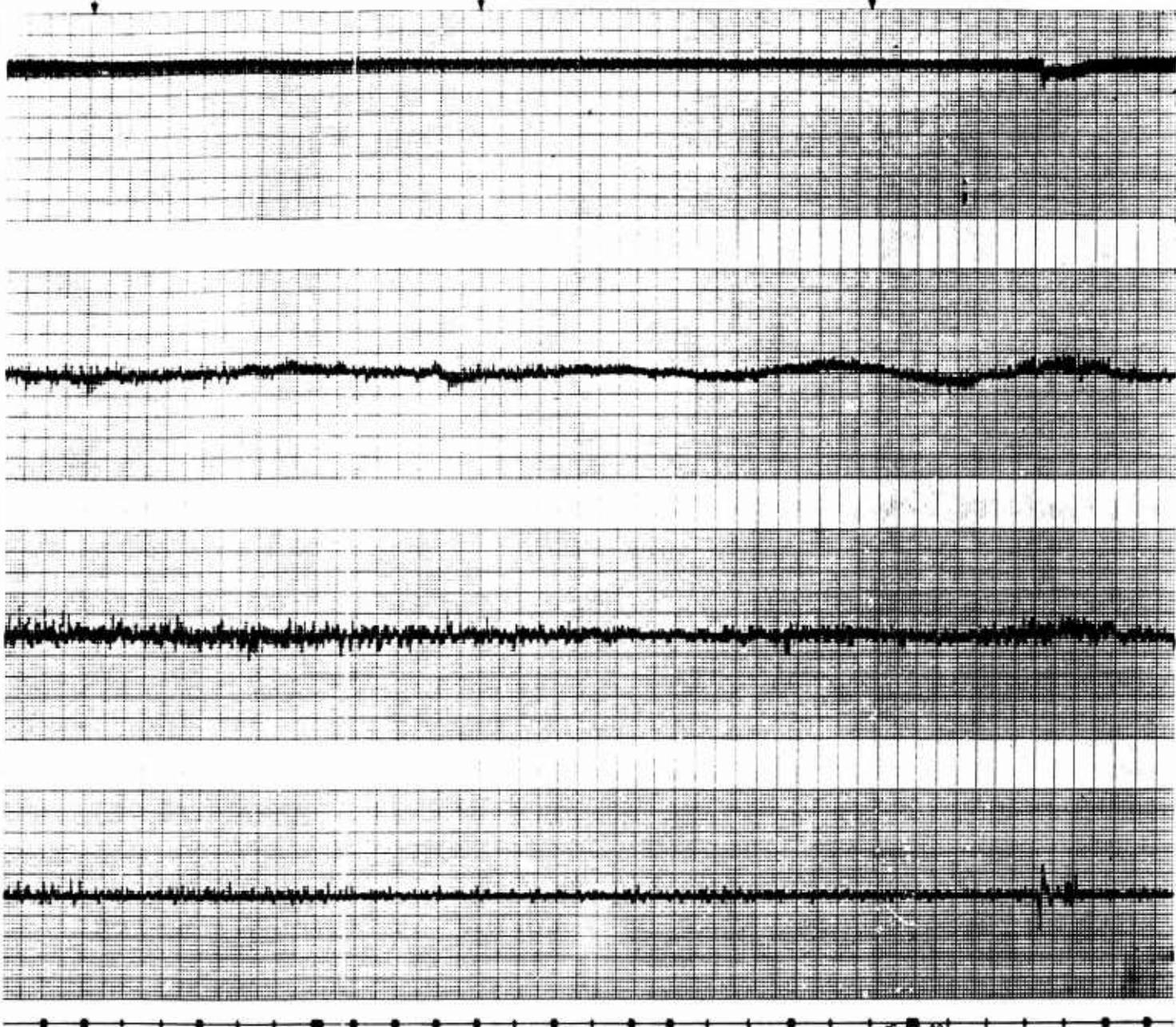
153 - 3



H+2600

H+2620

H+2630

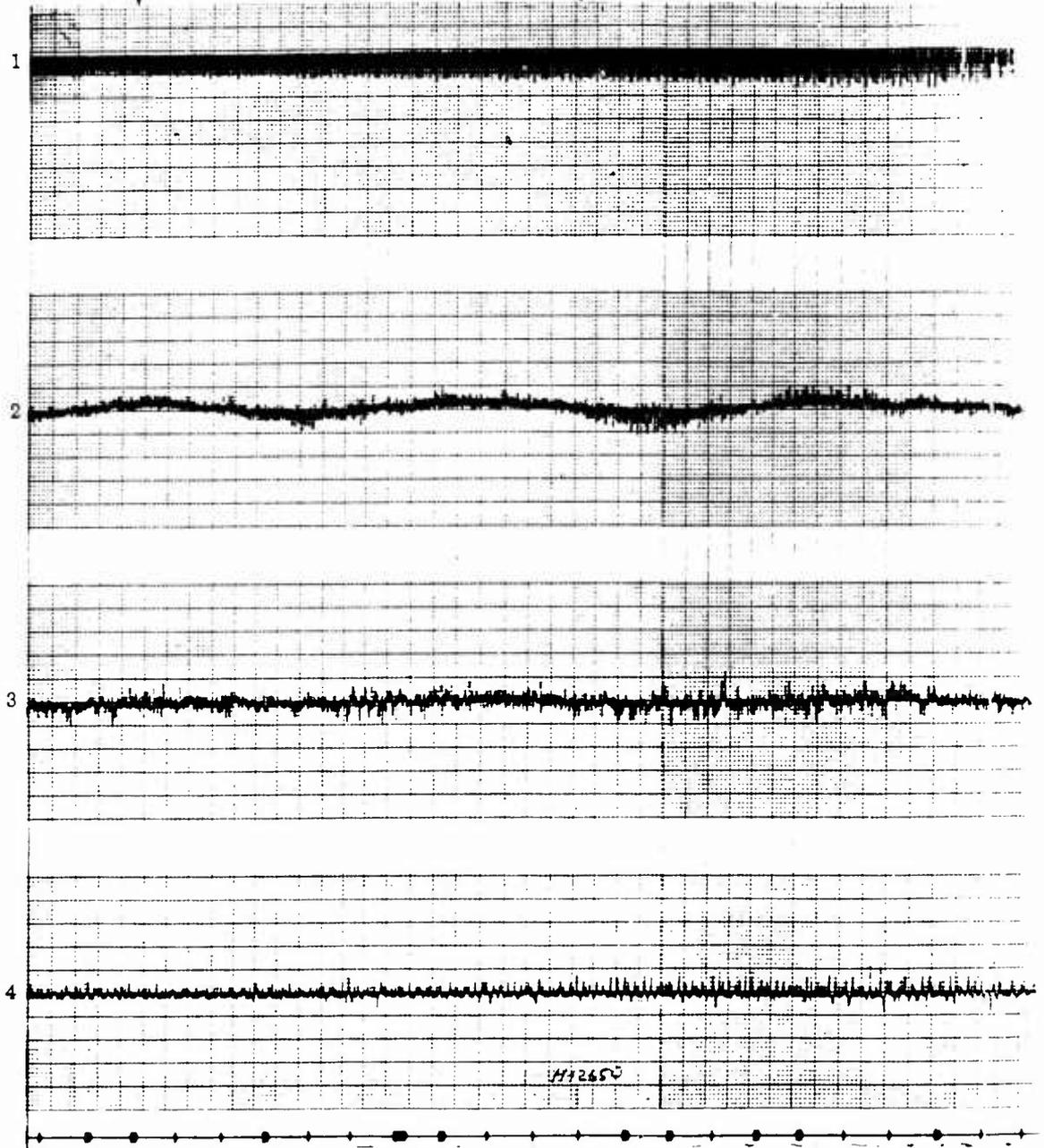


153-4



H+2640

H+2650



- 1 - AGC
- 2 - AZ ERROR
- 3 - EL ERROR
- 4 - RANGE ERROR

154-1

H+2670

H+2680

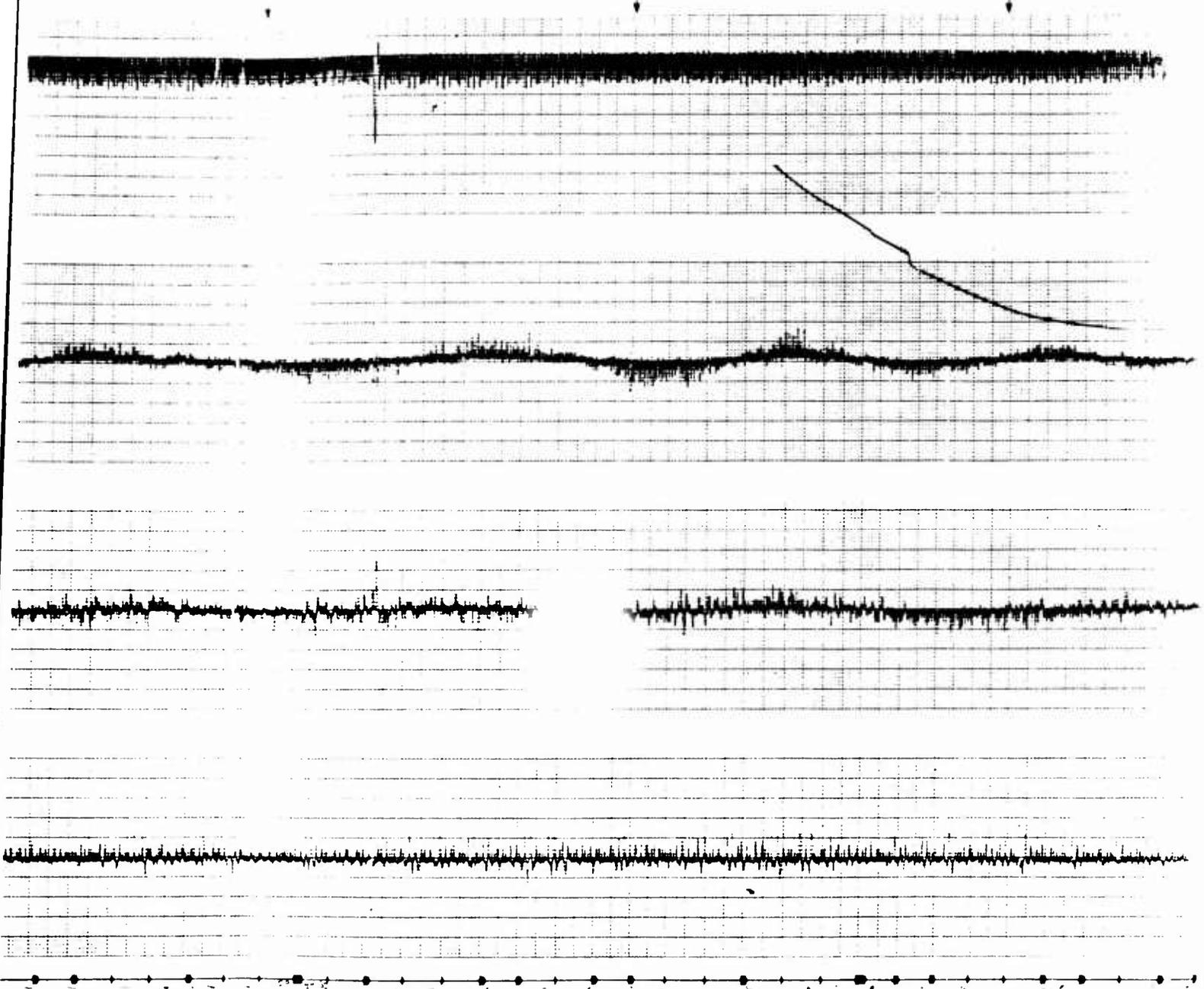
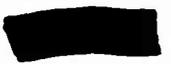


Figure B.7 Cc



BC

H+2697

H+2700

H+2710

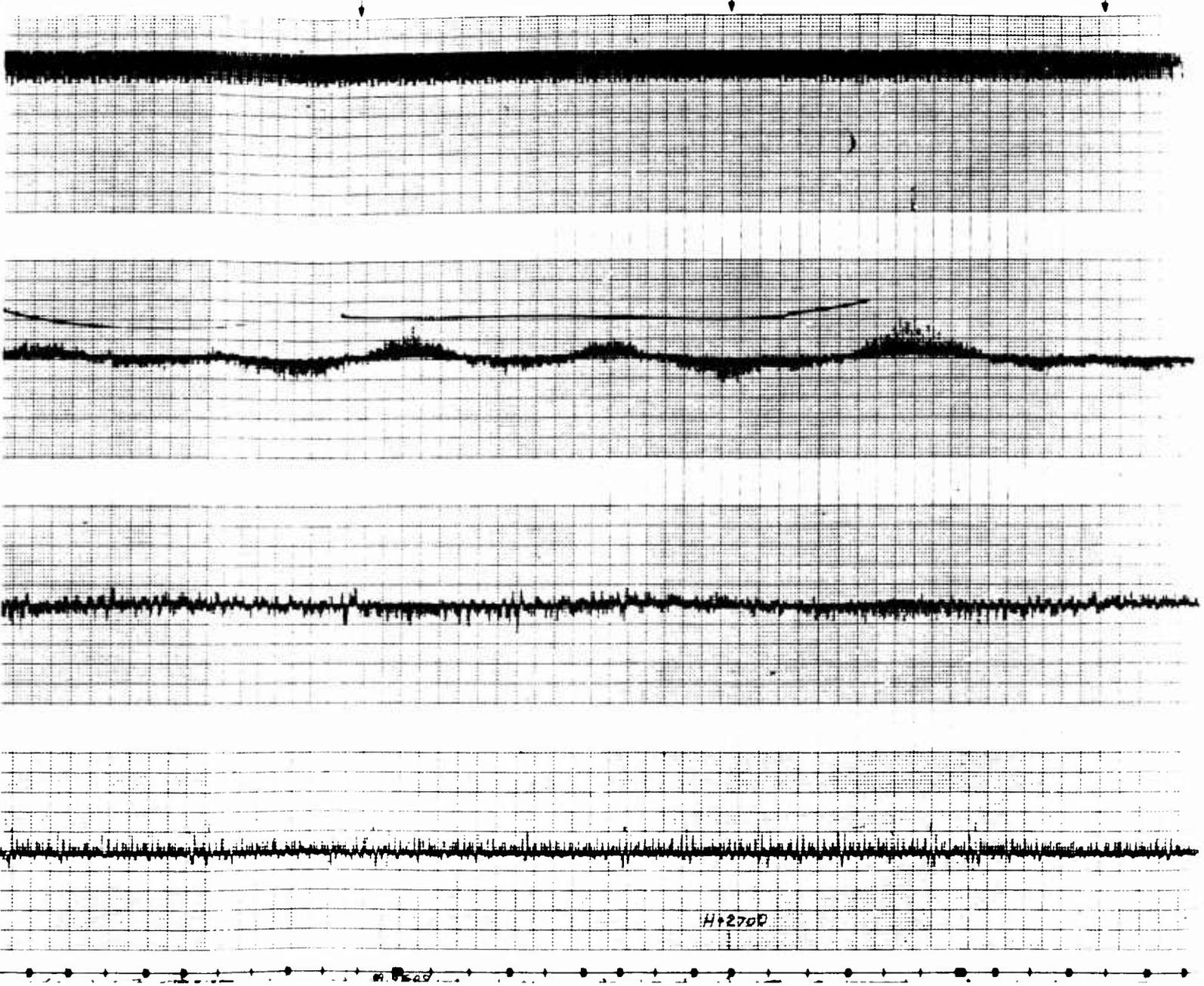
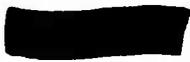


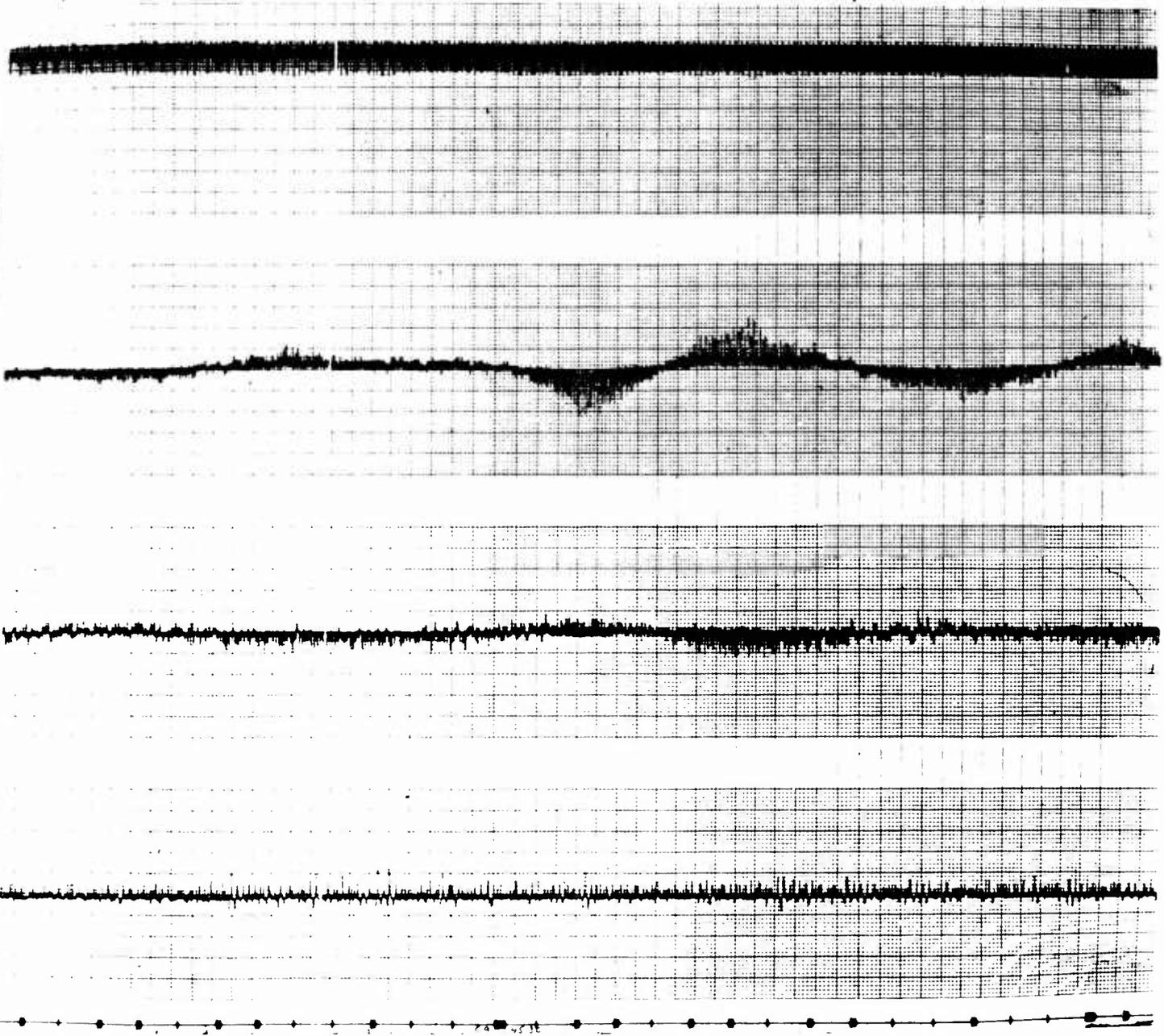
Figure B.7 Continued.

154 -3



H+ 2720

H+ 2730

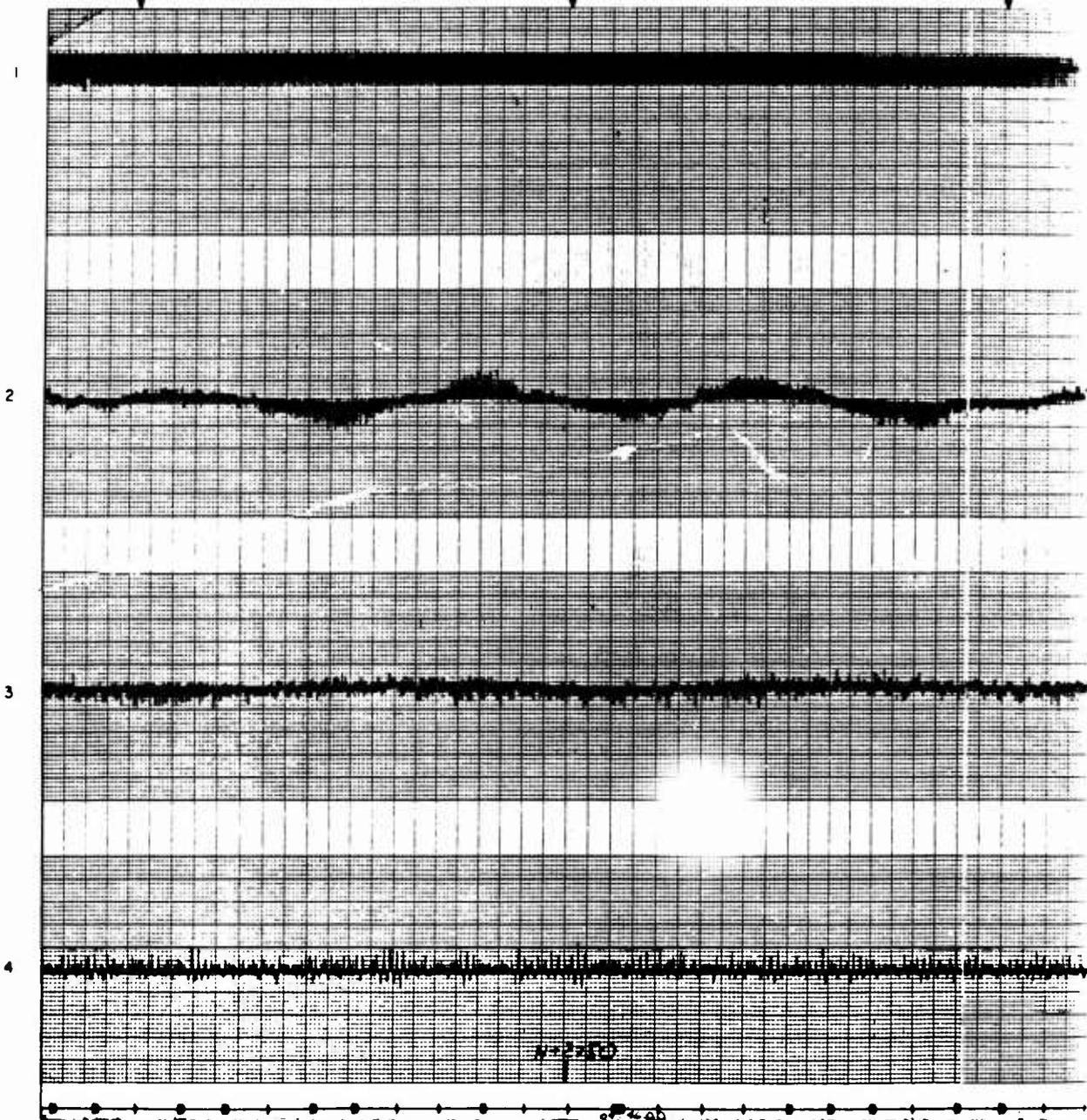


4

H+2740

H+2750

H+2760



- 1-AGC
- 2-AZ ERROR
- 3-EL ERROR
- 4-RANGE ERROR

155-1



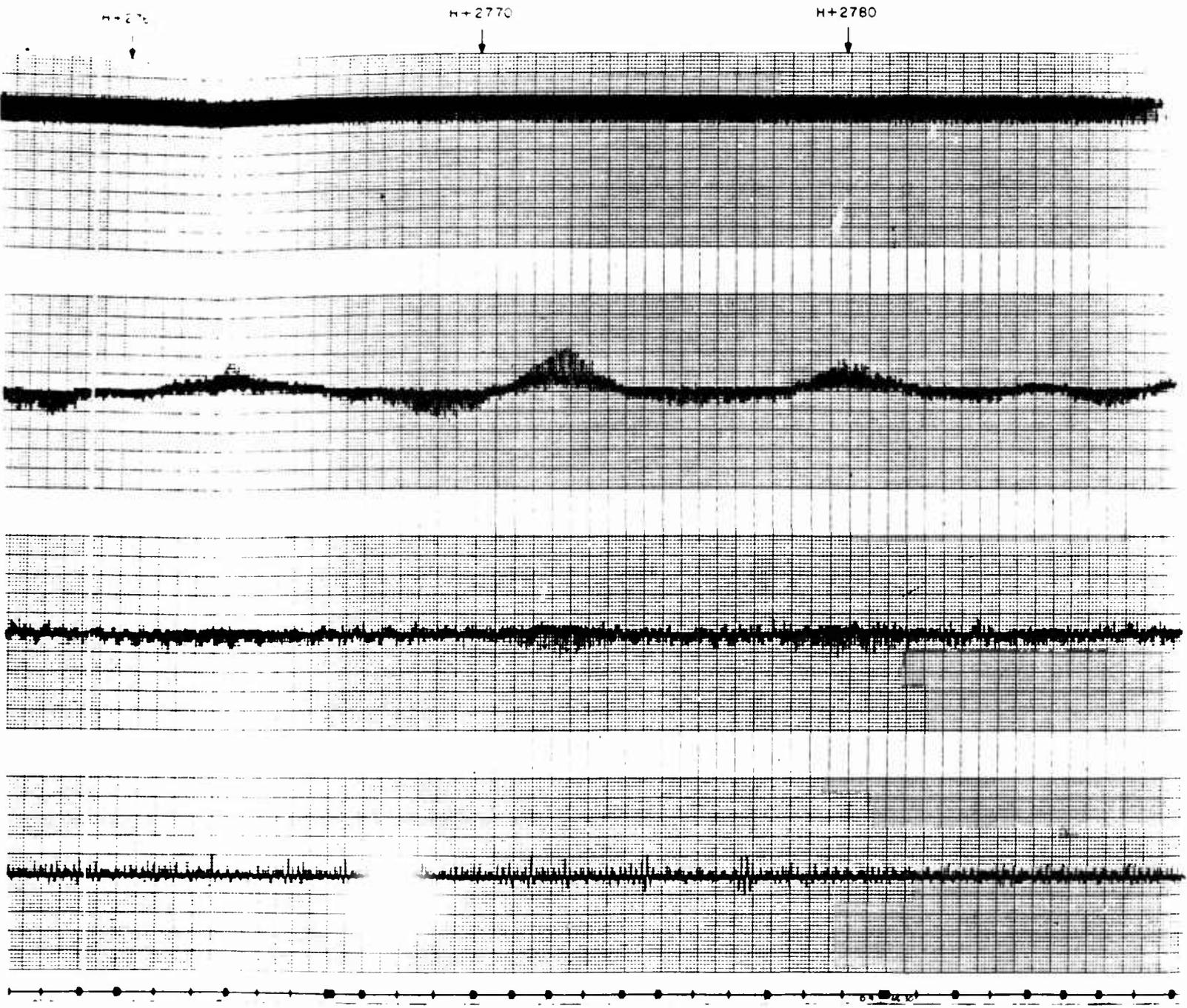
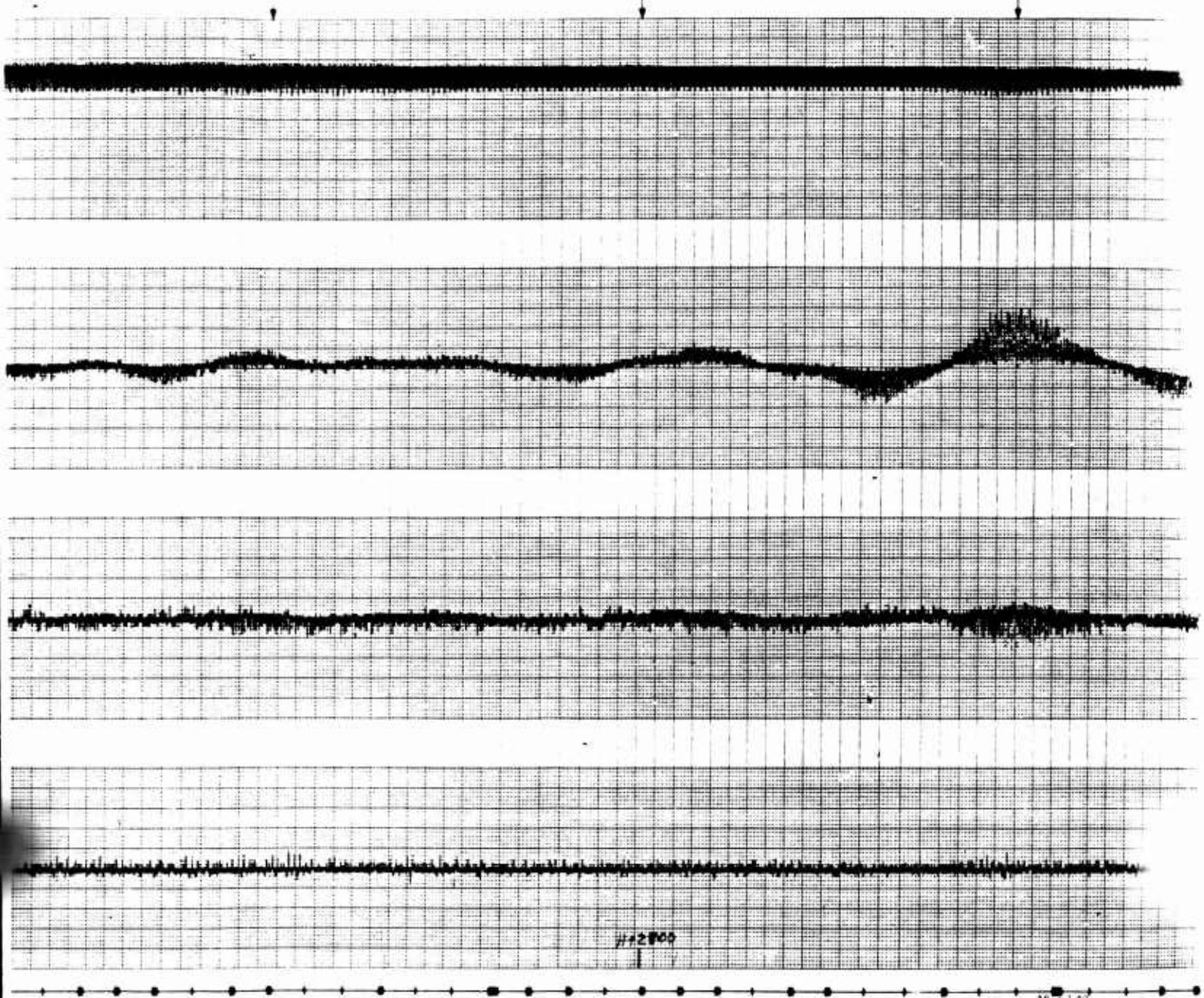


Figure B.7 Continued.

H+2700

H+2800

H+2810

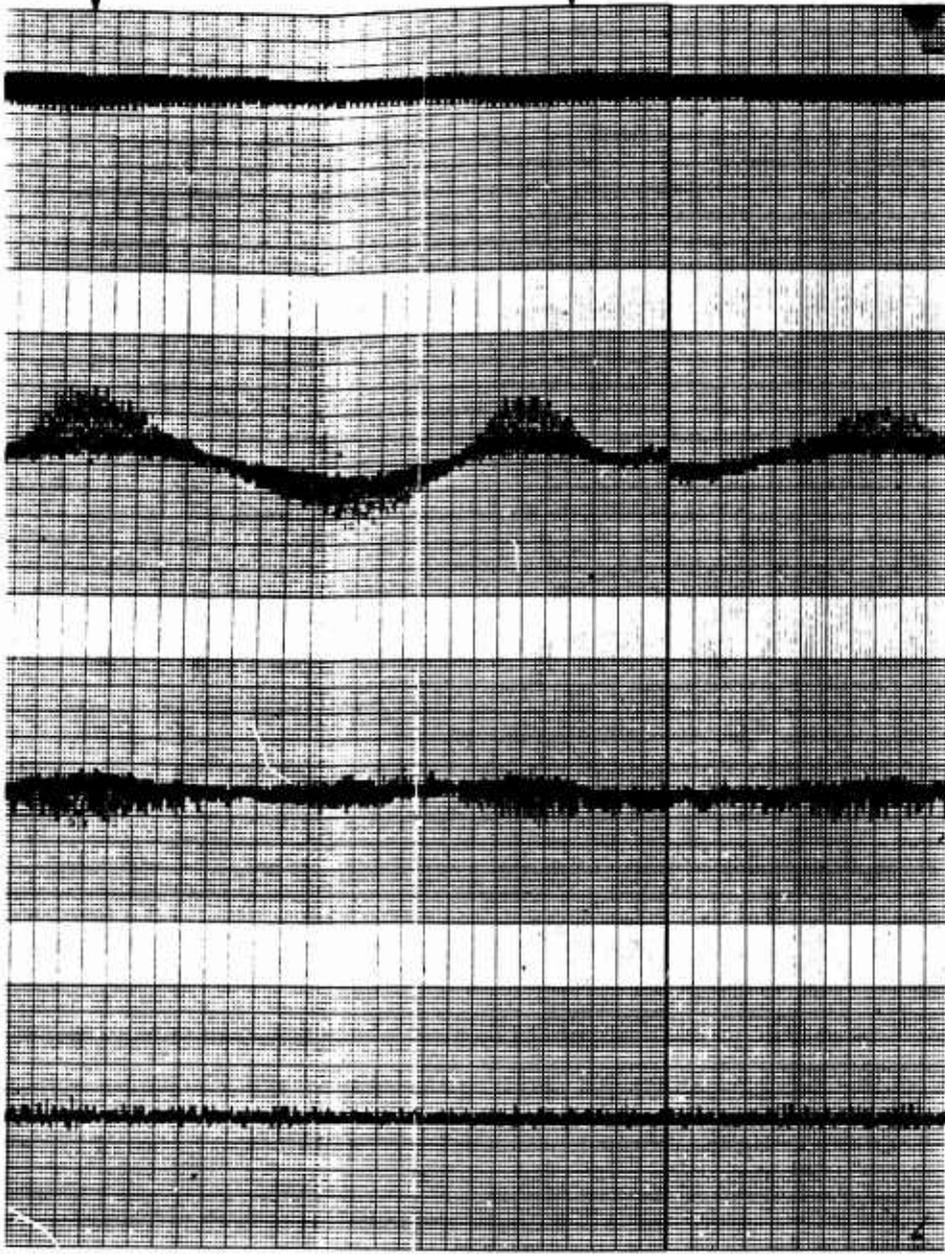


Continued.

155-3

H+2810

H+2820



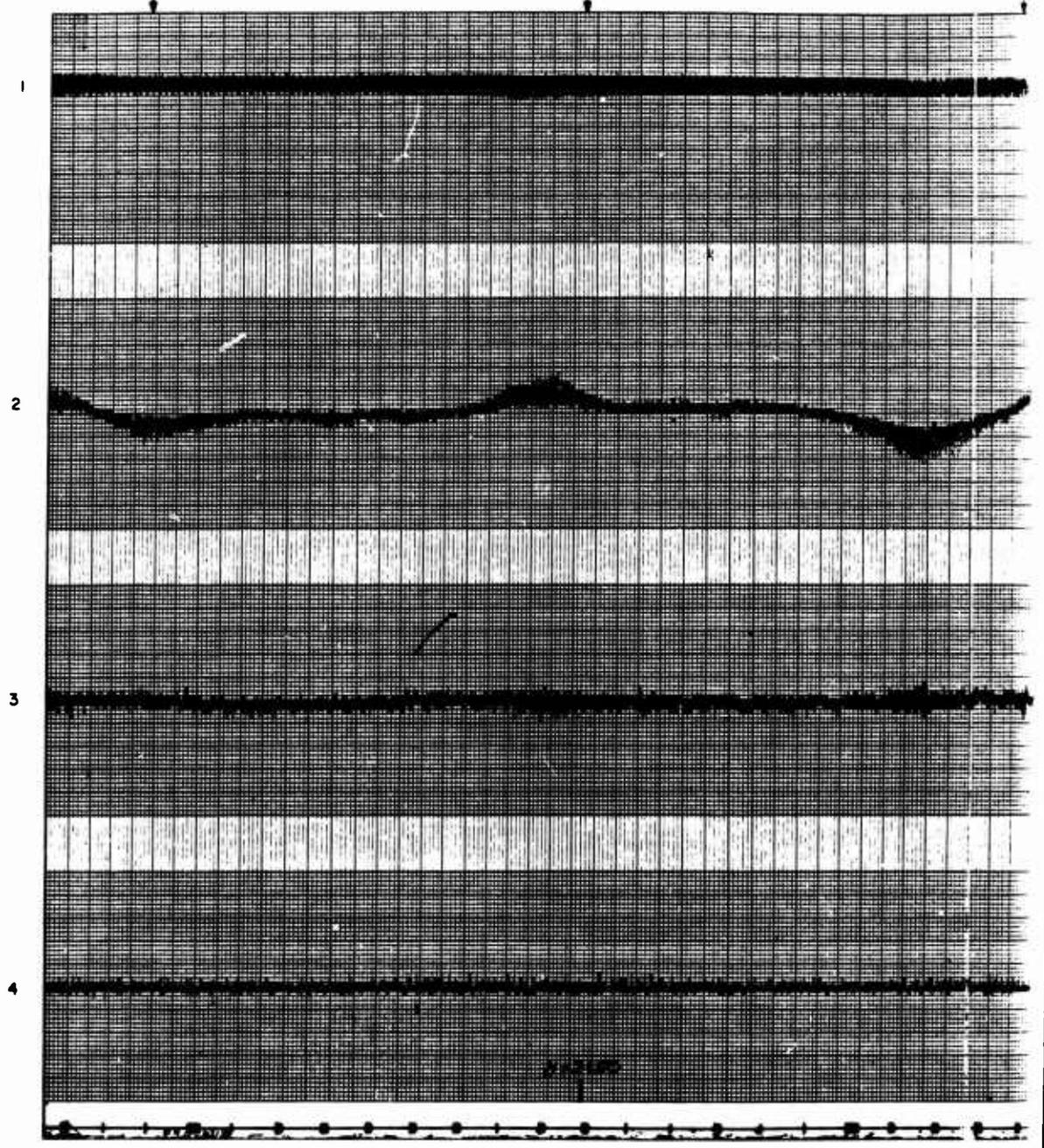
24 7.00

155-4

H+2840

H+2850

H+29



- 1-AGC
- 2-AZ ERROR
- 3-EL ERROR
- 4-RANGE ERROR

156-1



H+2860

H+2870

H+2880

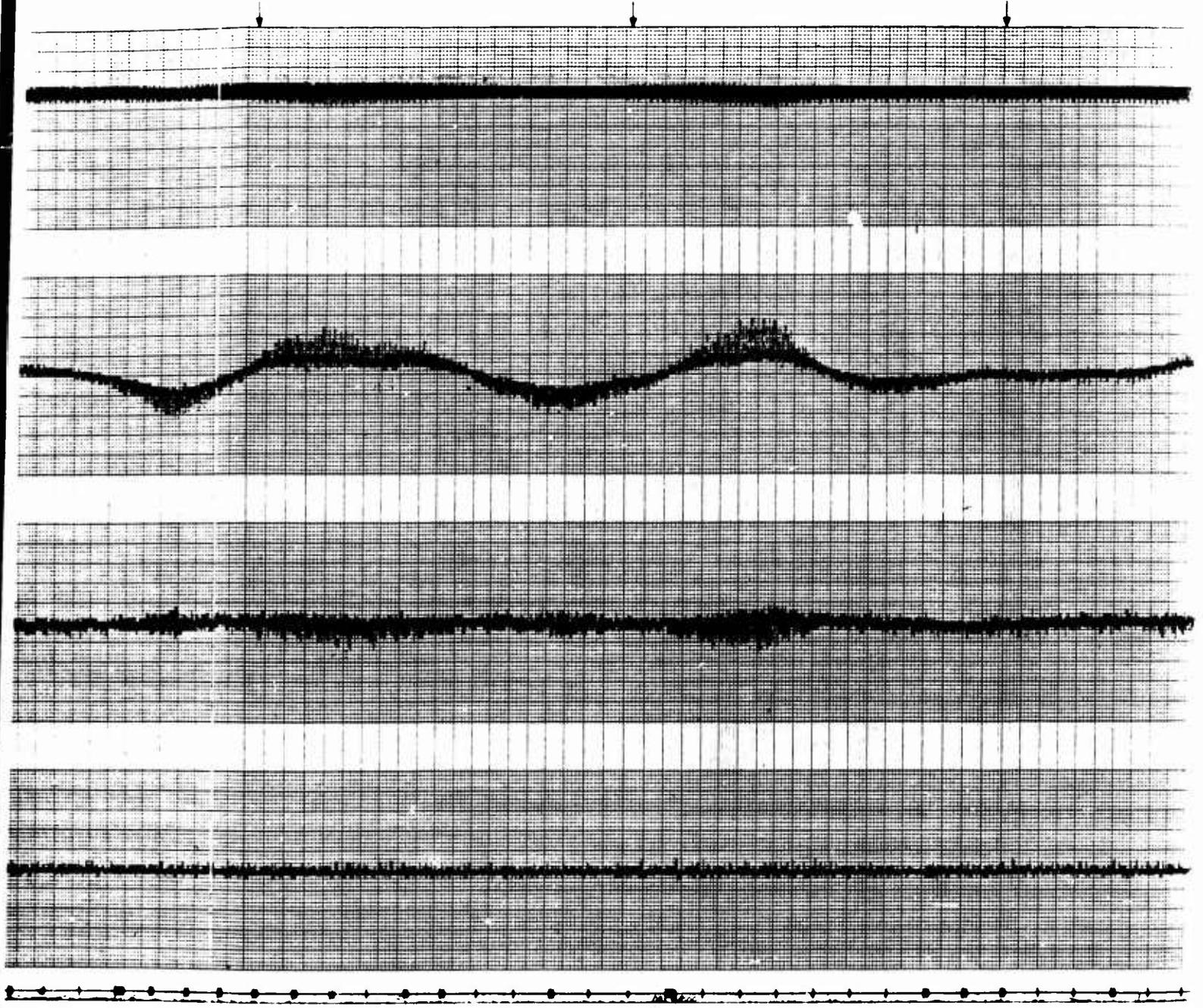


Figure B.7 Conti



H+2800

H+2900

H+29

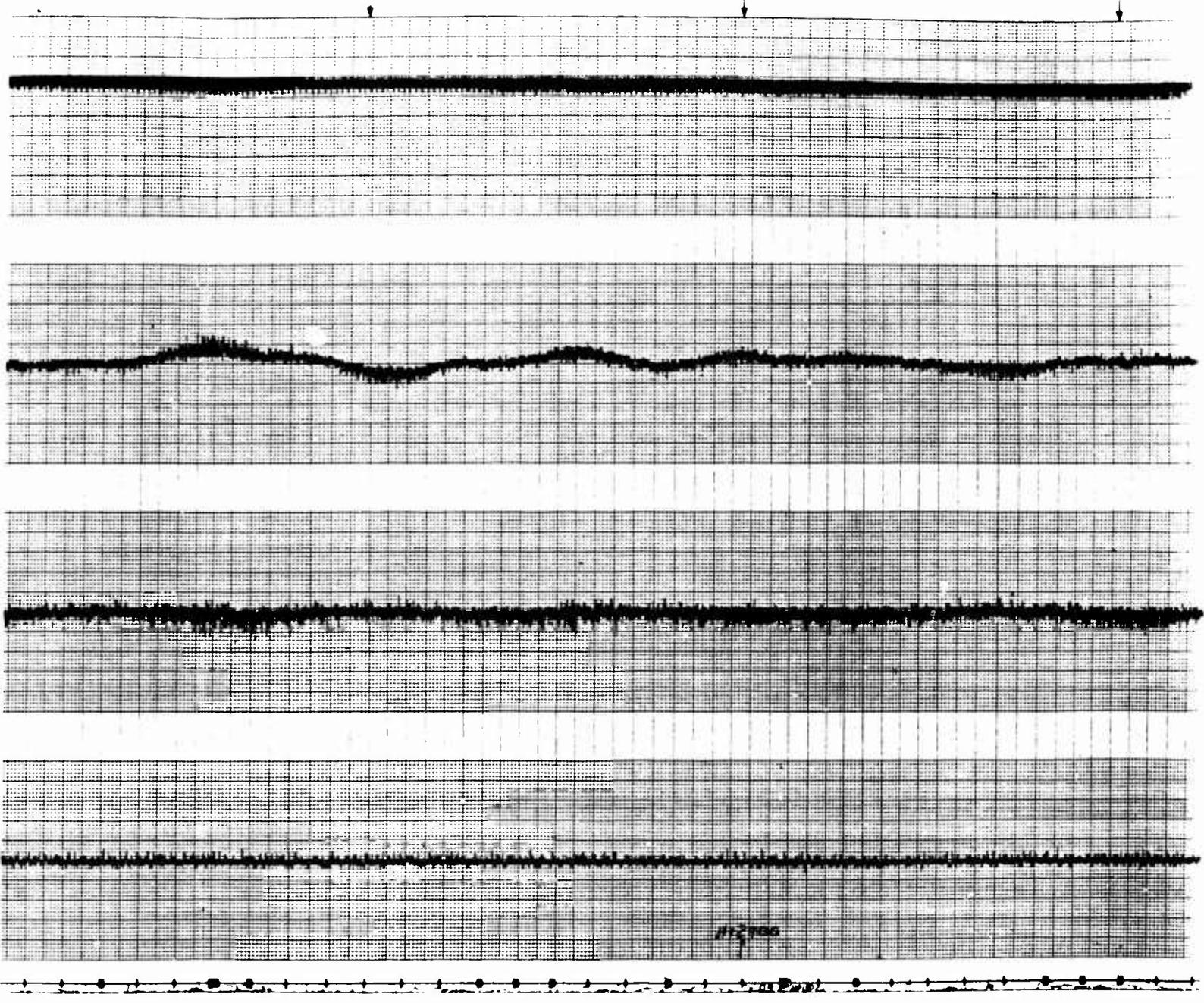


Figure B.7 Continued.

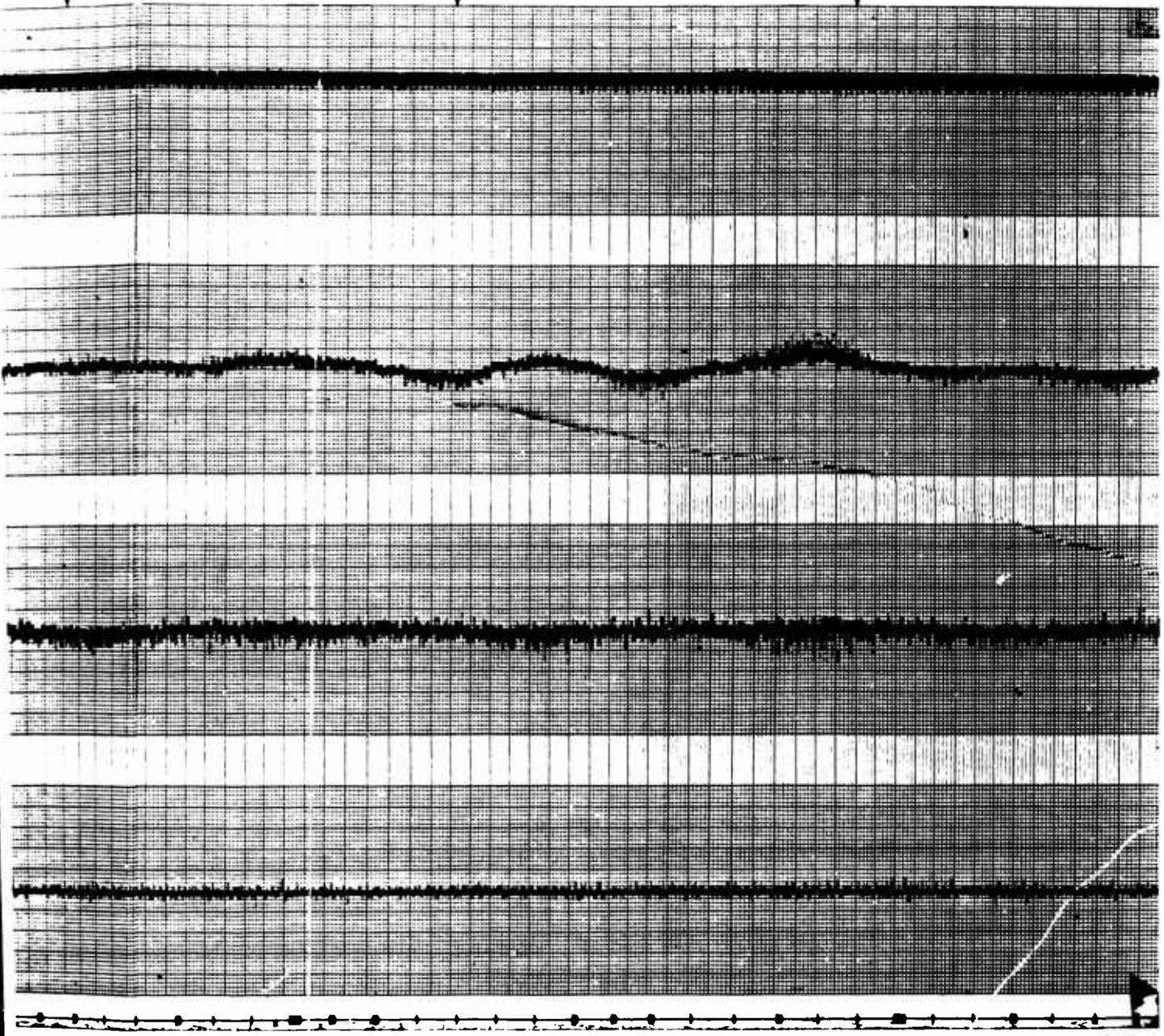
156-3



H+2910

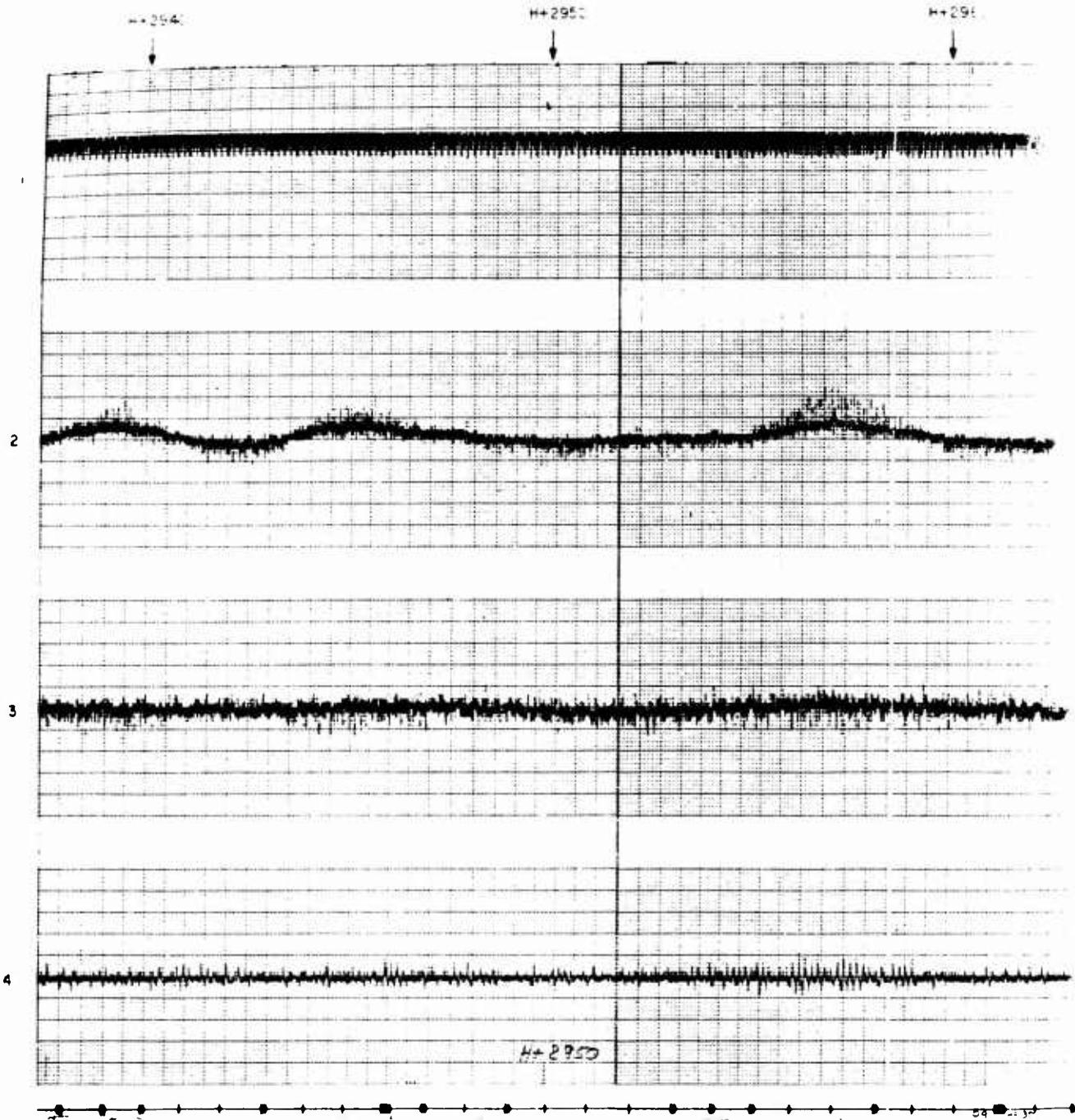
H+2920

H+2930



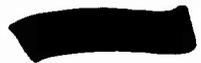
156-4





- 1- AGC
- 2- AZ ERROR
- 3- EL ERROR
- 4- RANGE ERROR

157-1



H+2960

H+2970

H+2980

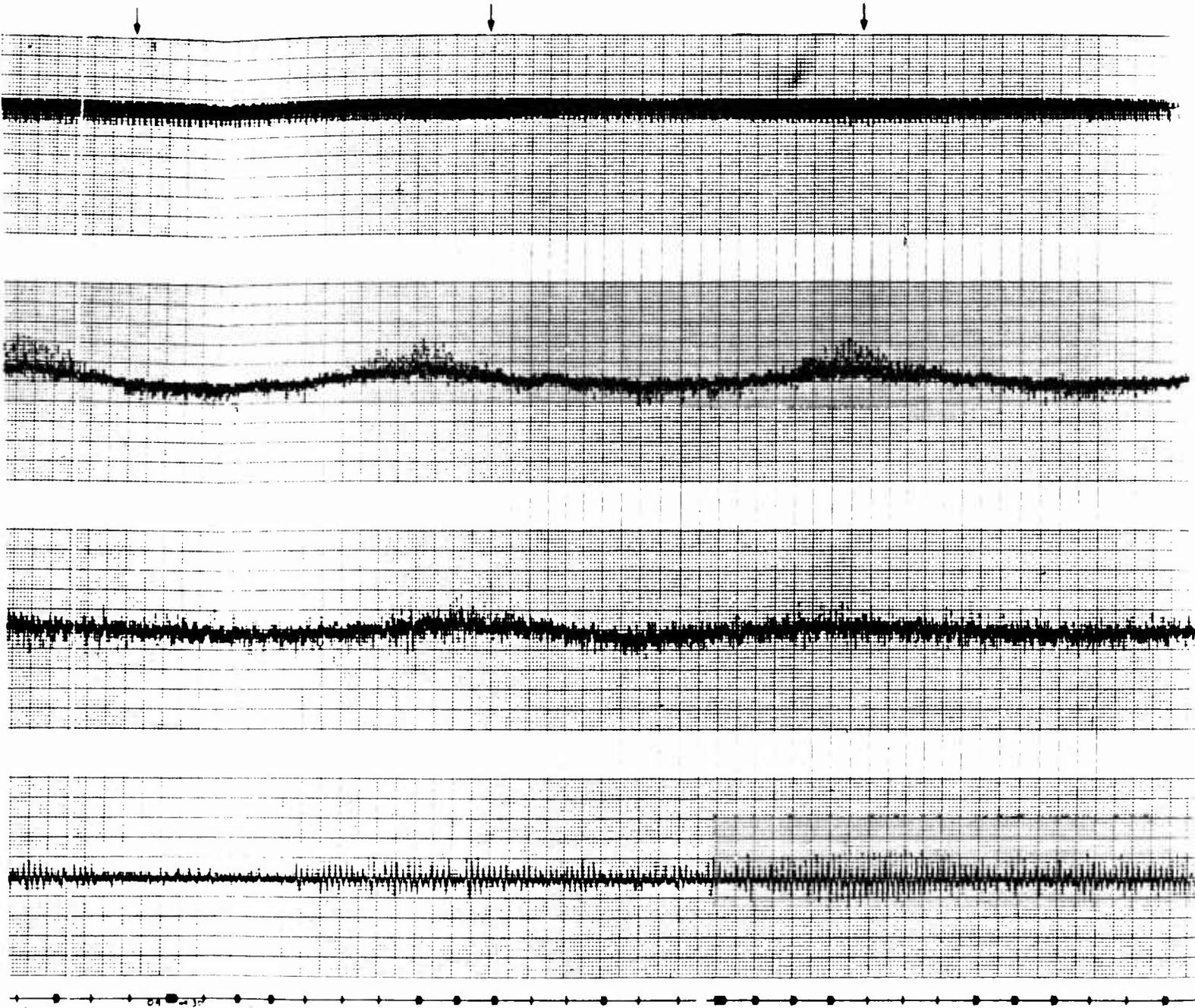


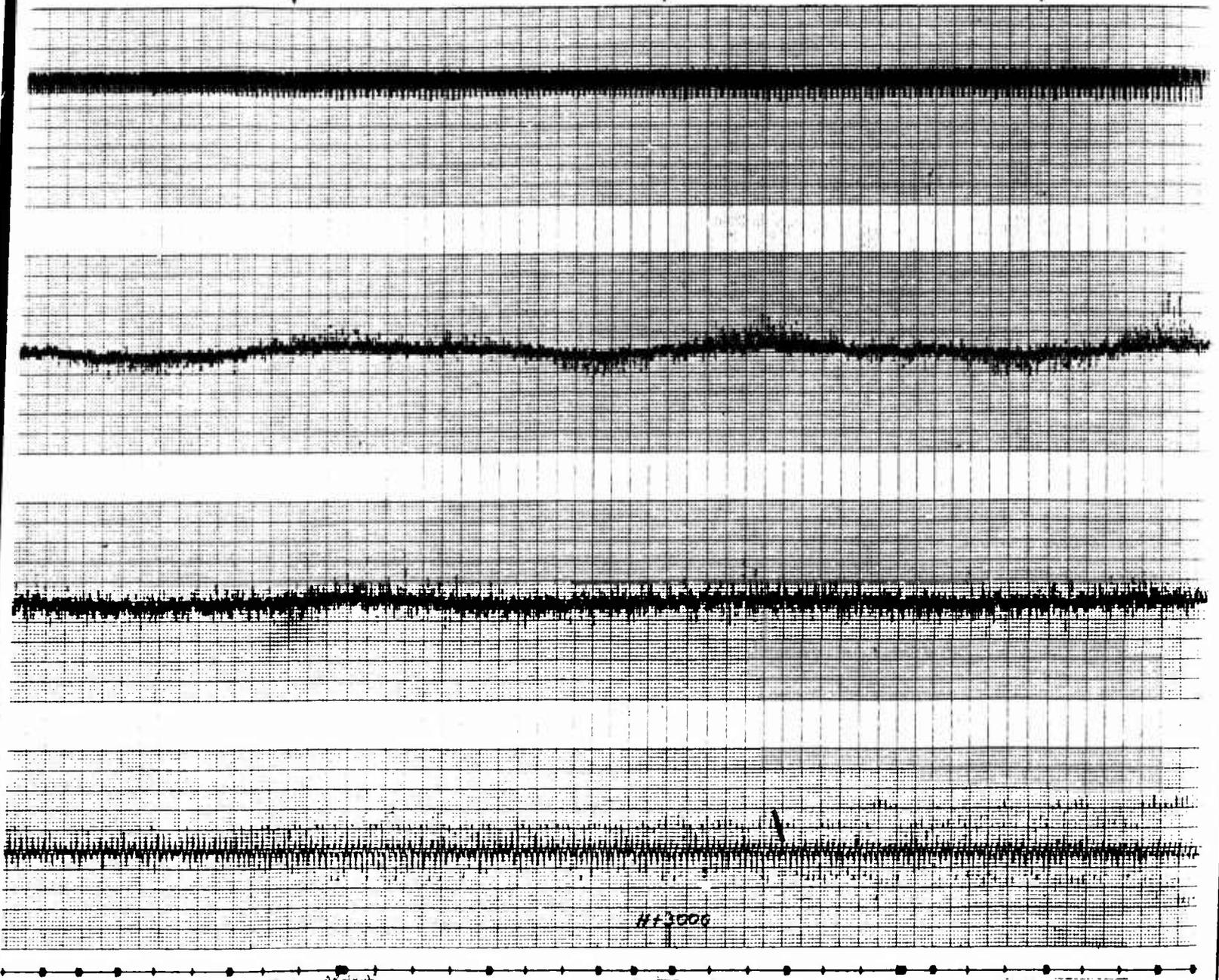
Figure B.7 Continued.



H+2990

H+3000

H+3010



B.7 Continued.

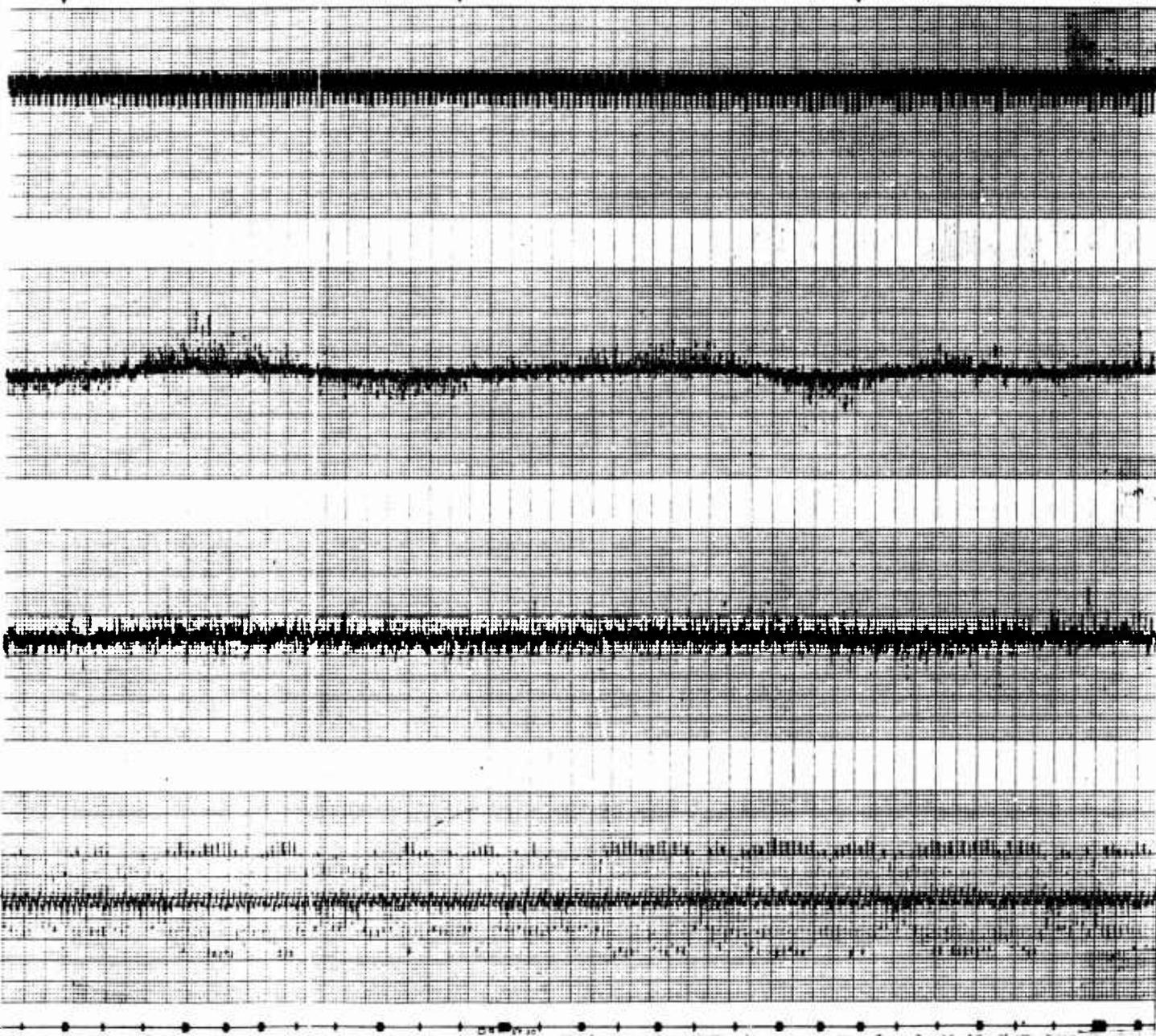
157 -3



H+3010

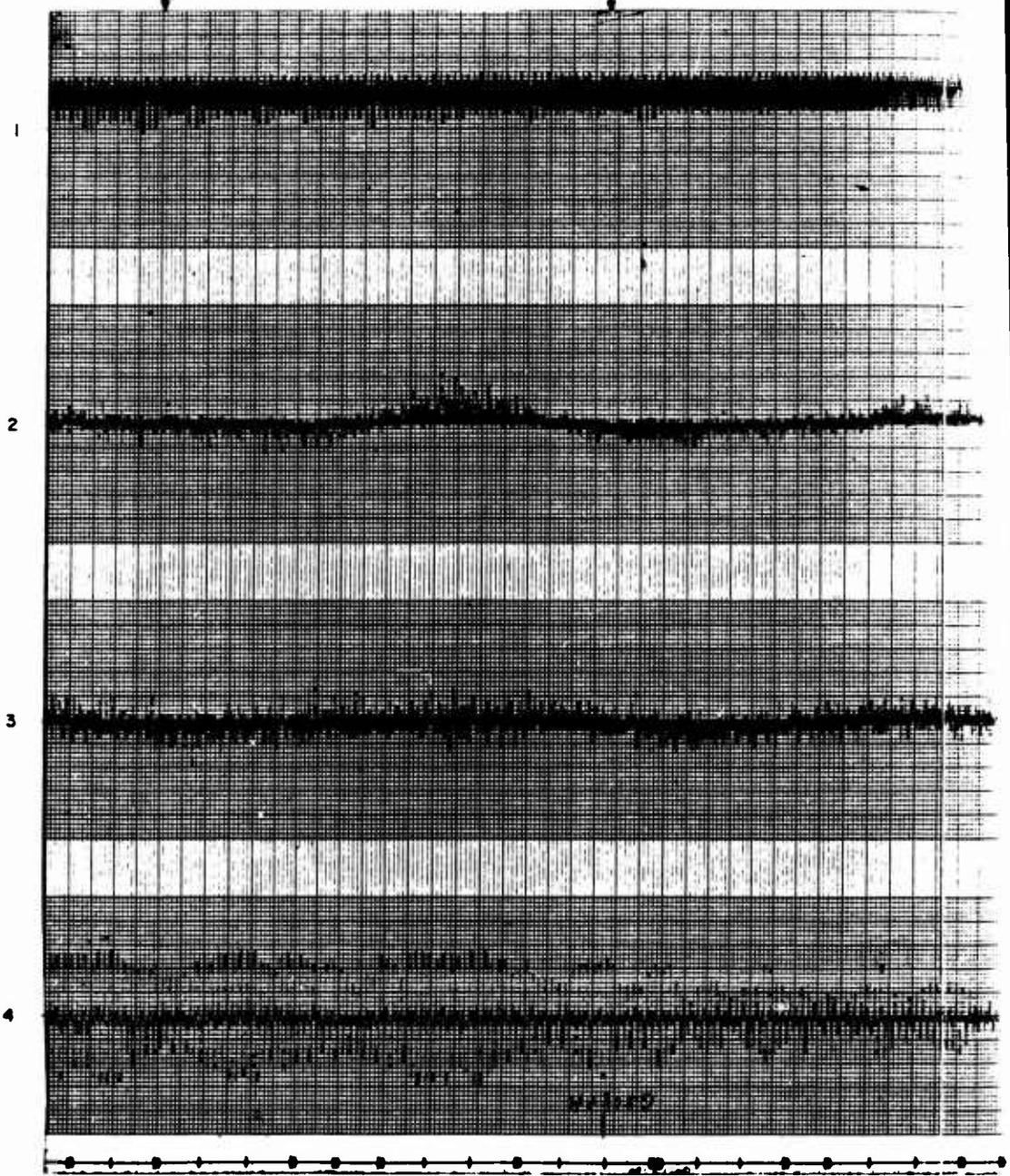
H+3020

H+3030



H+3040

H+3050



- 1 - AGC
- 2 - AZ ERROR
- 3 - EL ERROR
- 4 - RANGE ERROR

158-1



H+3060

H+3070

H+3080

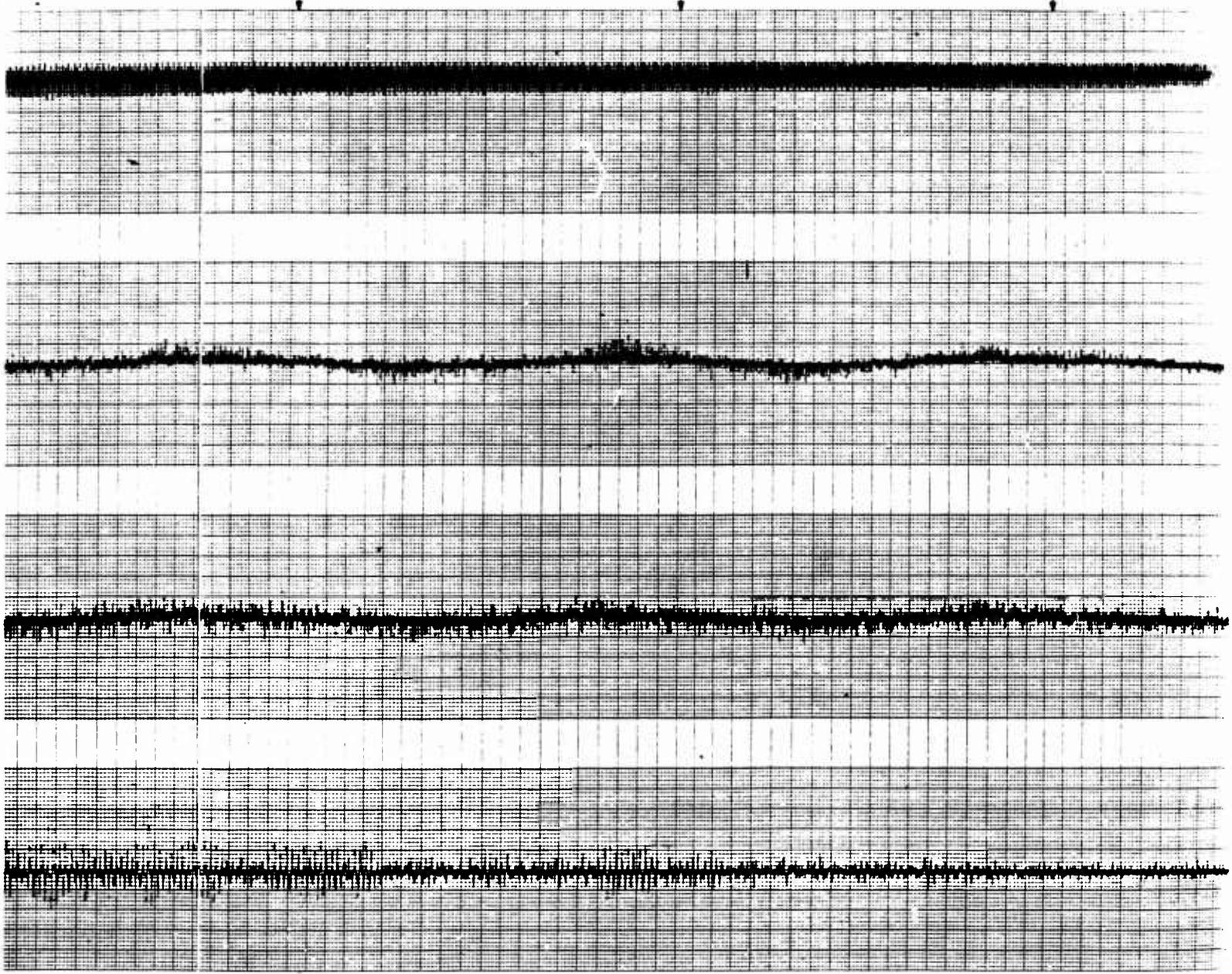
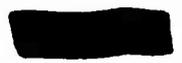


Figure B.7 Conti



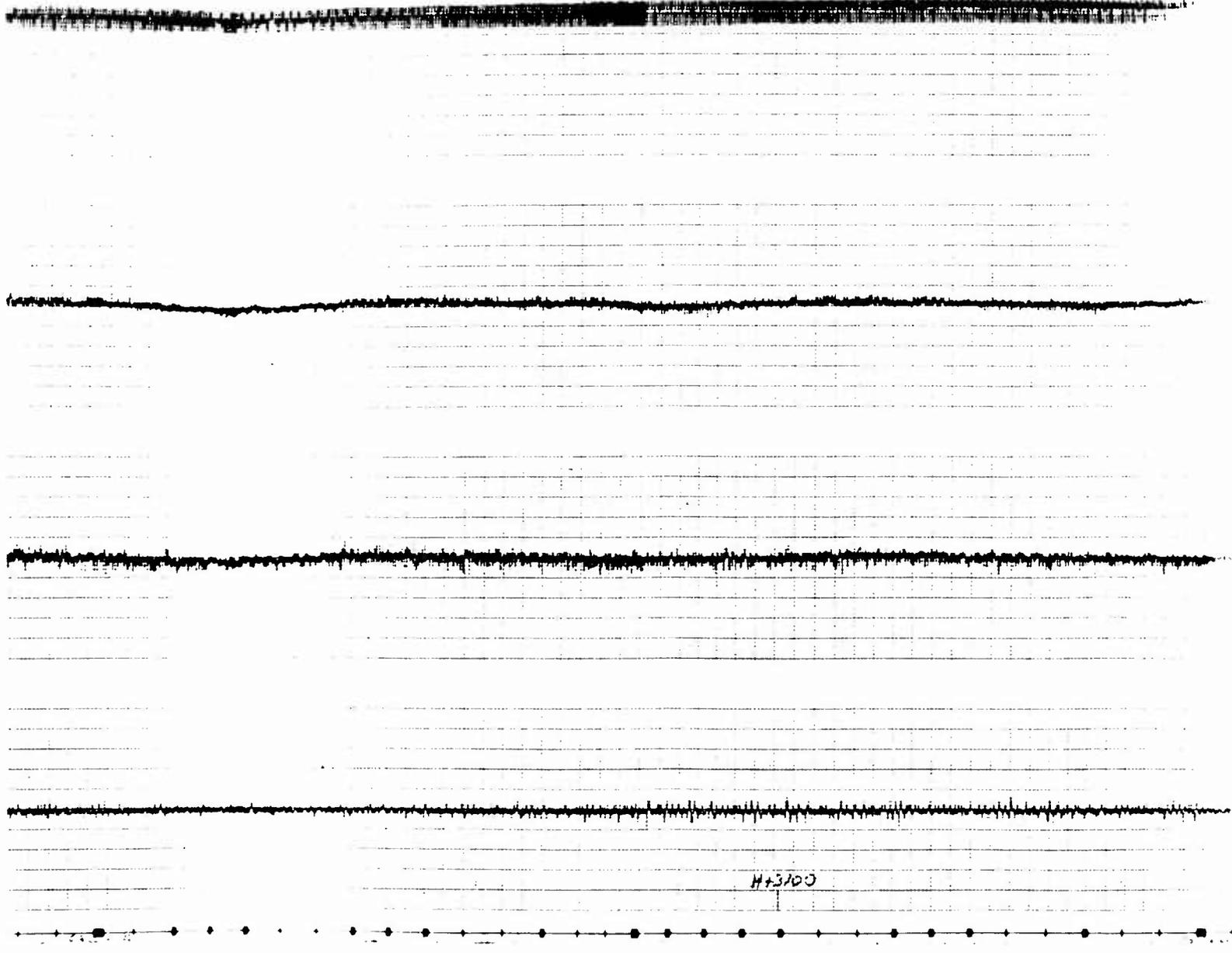


Figure B.7 C-3

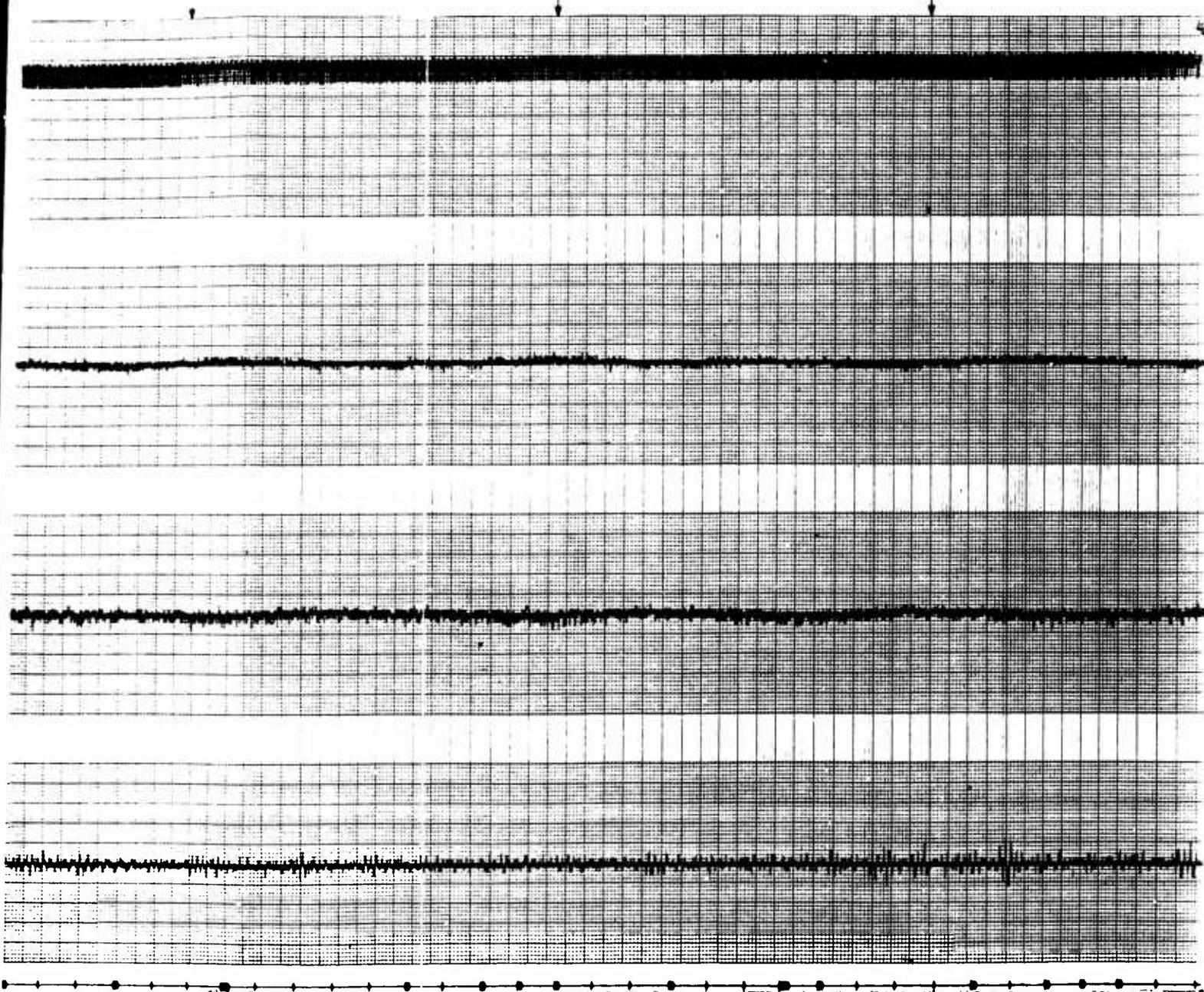
158-3



H+310

H+3120

H+3130

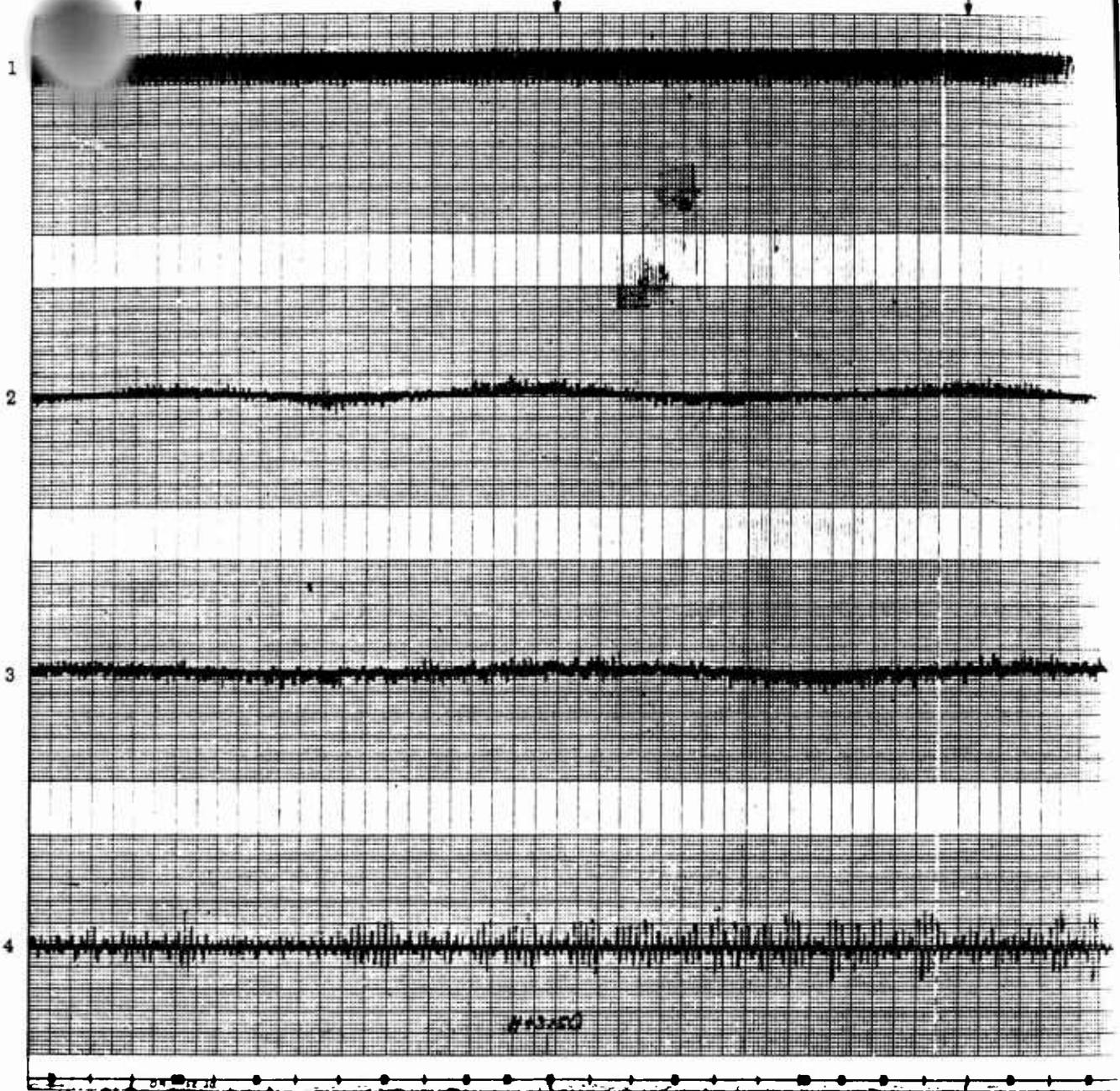


SS-4

H+3140

H+3150

H+3160



- 1 - AGC
- 2 - AZ ERROR
- 3 - EL ERROR
- 4 - RANGE ERROR

159-1

H+3:60

H+3:70

H+3:80

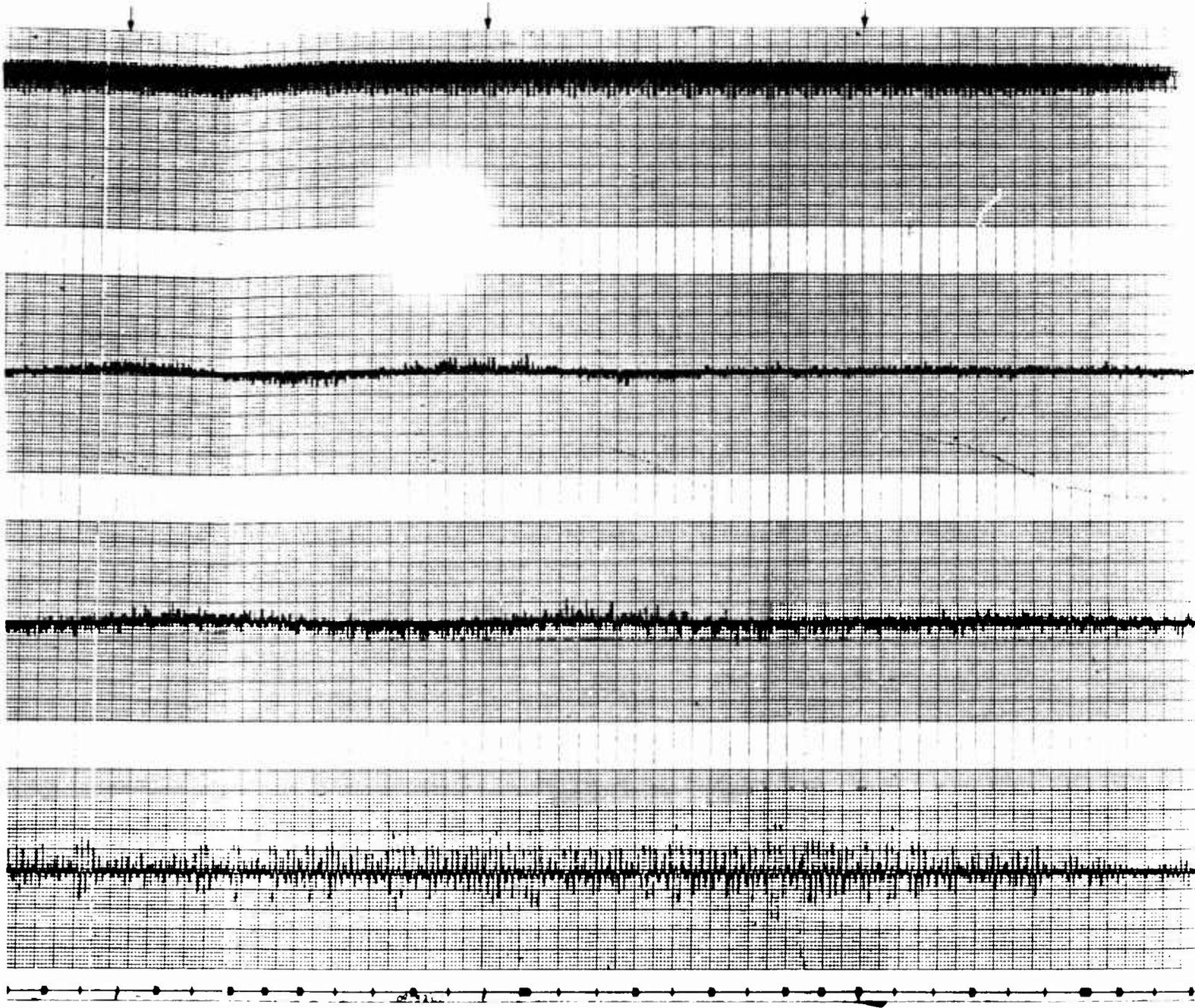


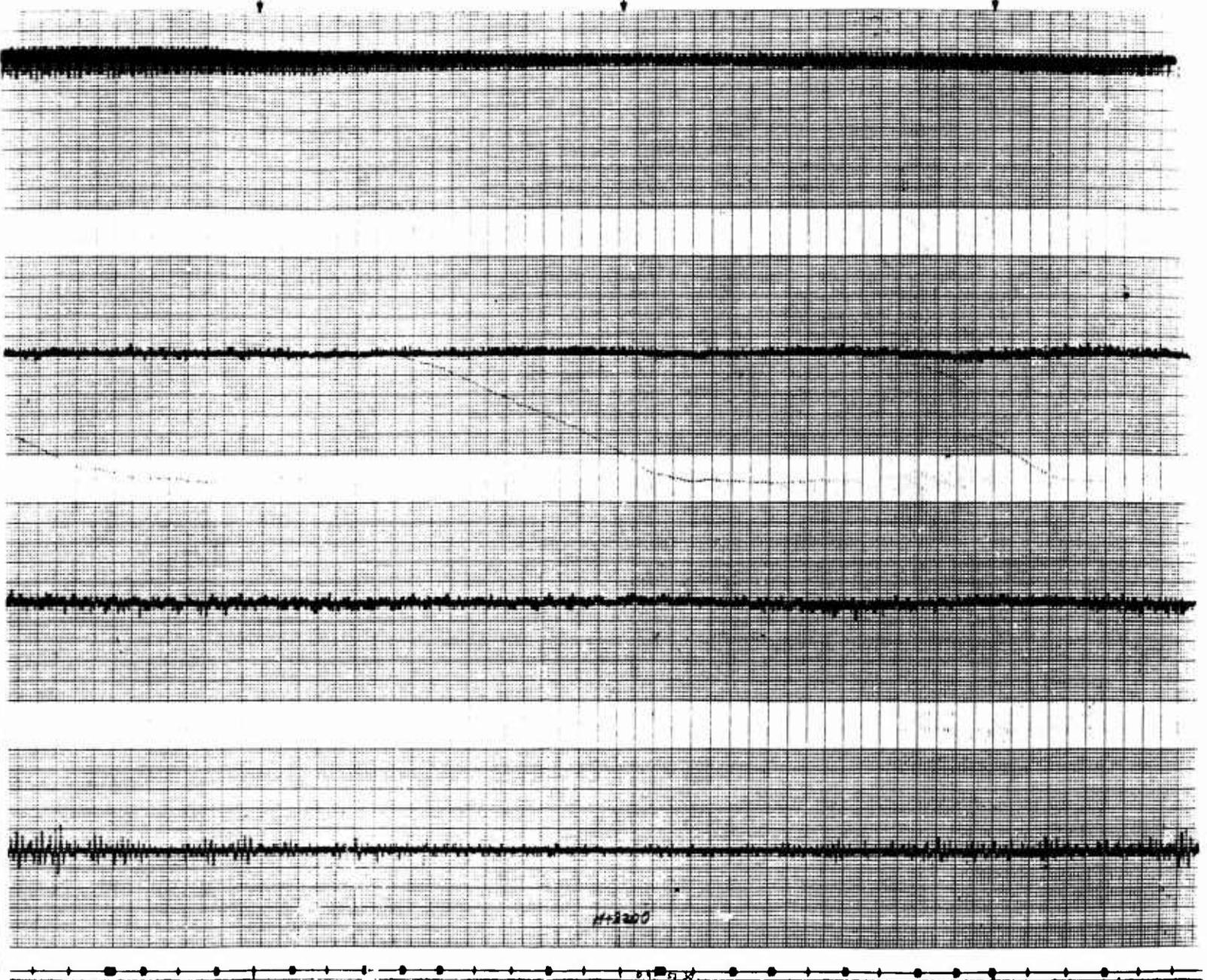
Figure B.7 Cont.



H-3190

H+3200

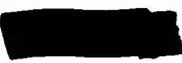
H+3210



H+3200

Figure B.7 Continued.

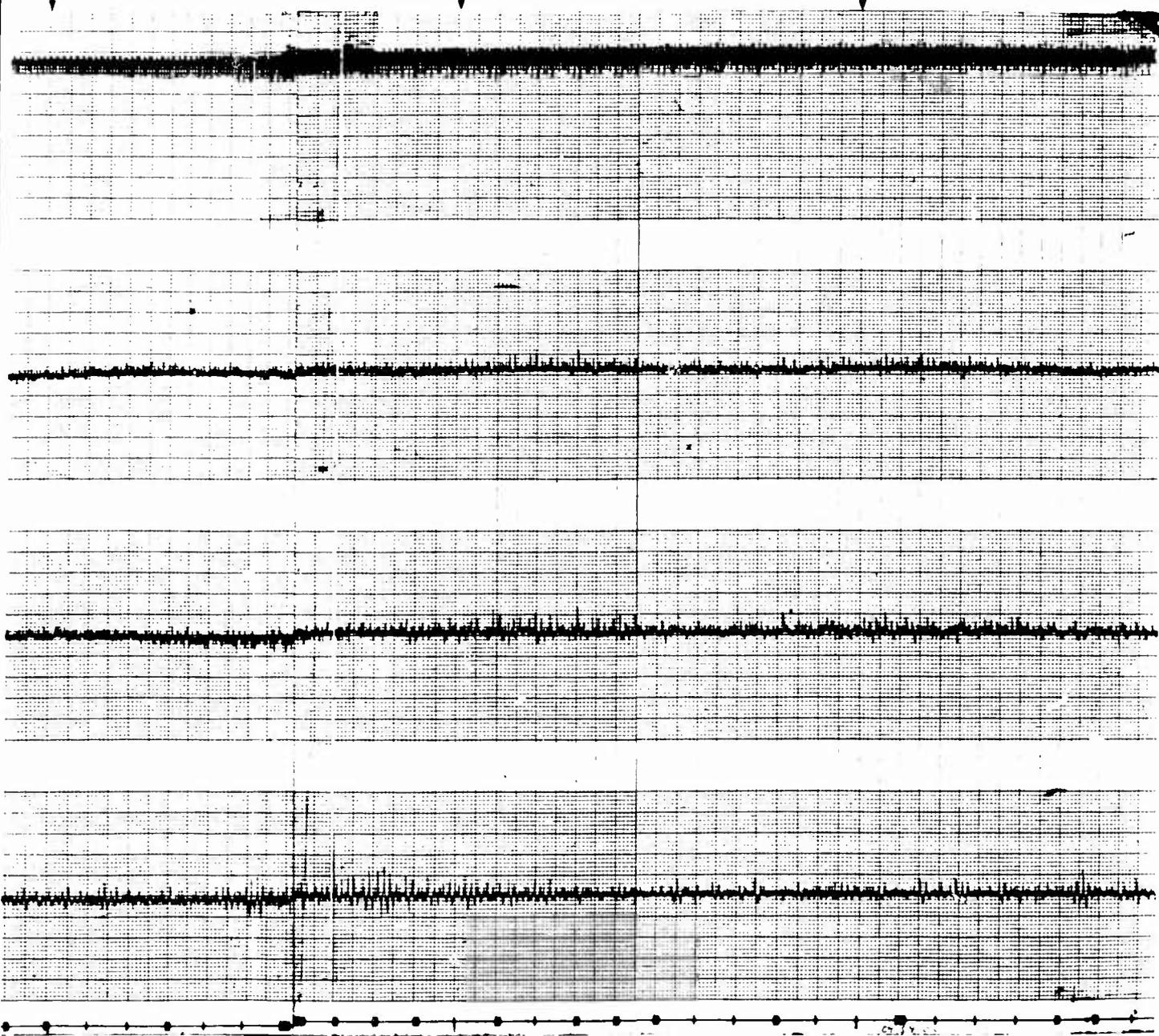
159 - 3



H+3220

H+3220

H+3230



59.4

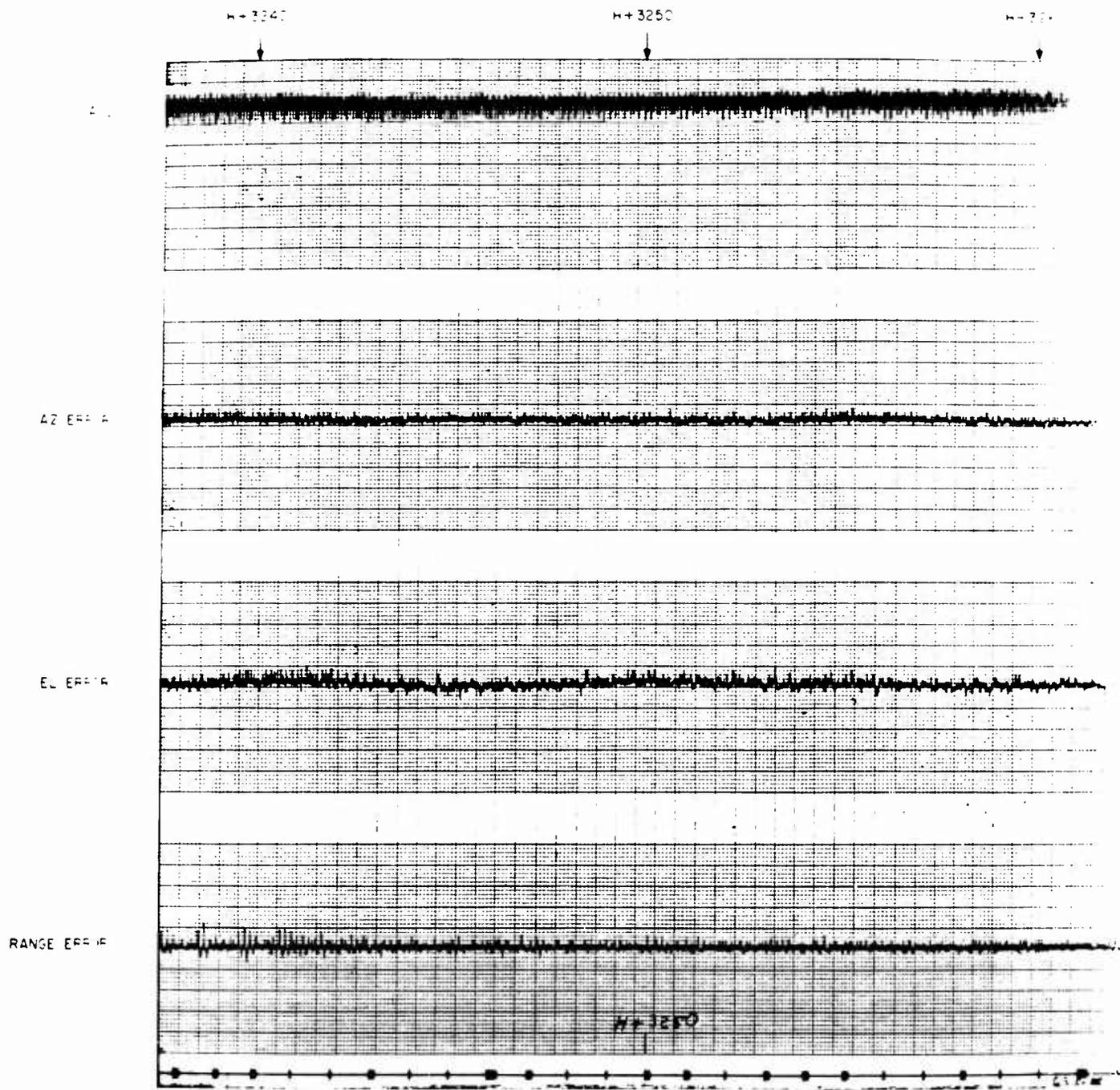
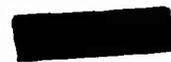


Figure B.7 Cont



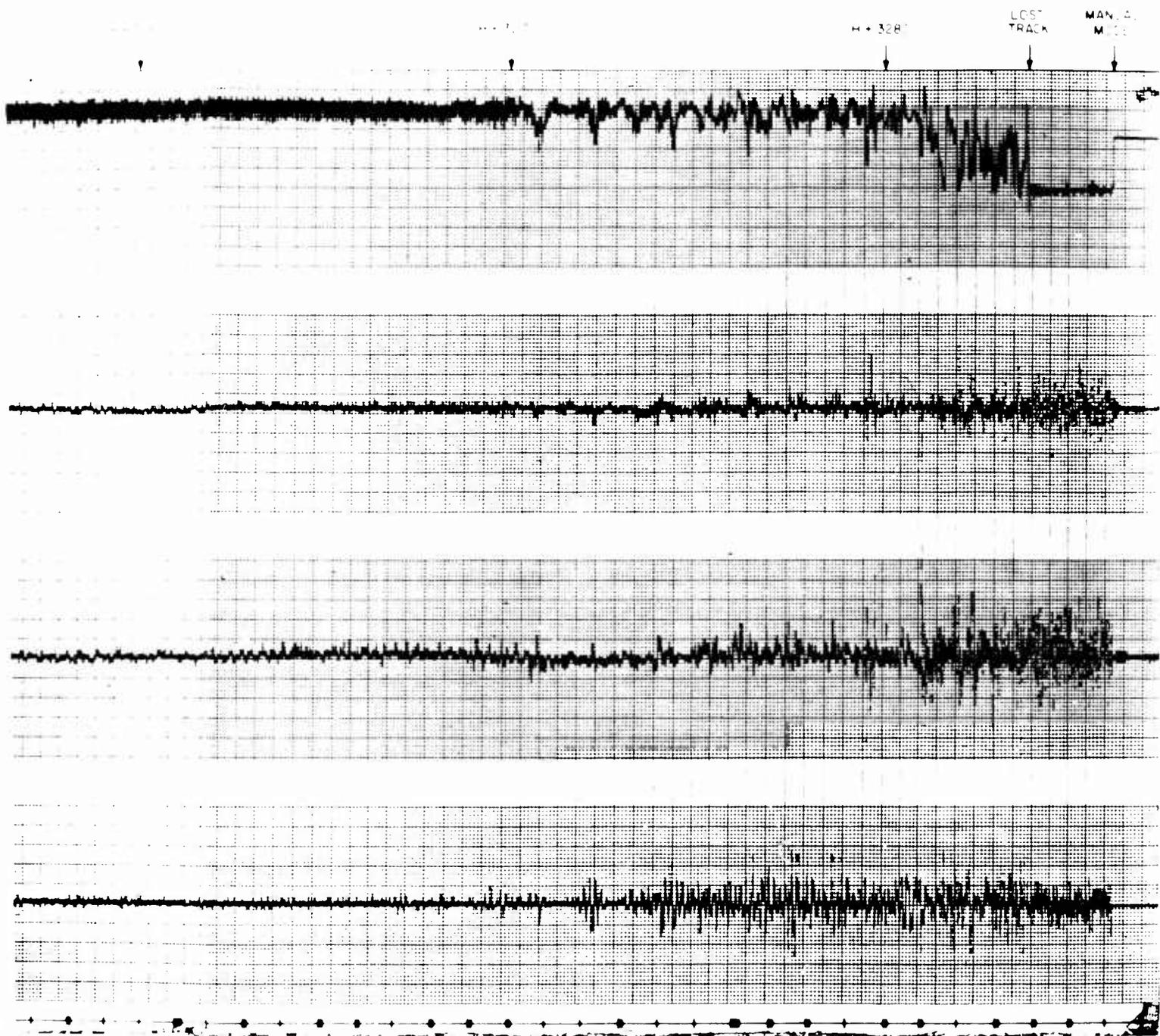


Figure 17 - Continuation

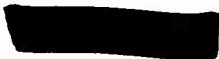
APPENDIX C
 TRAJECTORY DATA, UHF/L-BAND

Star Fish Prime clutter mapping look angles

Raw data referenced to the ship		Quantities have been translated to the launcher position									
Time, sec	Range, km	Azimuth, deg T	Elevation, deg (geod.)	x, km distance east	y, km distance north	z at launcher	$\sqrt{x^2 + y^2}$, km	Height above earth, kft	Height above earth, km	Latitude of target, deg	Longitude of target, deg

101.00	165.20	13.15	66.67	89.63	60.05	88.70	60.96	89.21	135.31	169.7867
111.00	169.20	12.30	63.55	89.29	60.54	92.60	61.91	90.21	137.47	169.7867
111.00	169.20	11.15	63.52	89.29	60.54	92.60	61.91	90.21	137.47	169.7867
112.00	169.20	11.76	66.60	89.67	60.13	92.60	61.91	90.21	137.47	169.7867
113.00	169.20	12.11	66.22	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
115.00	169.20	12.17	63.66	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
116.00	169.20	12.03	63.04	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
116.00	169.20	11.31	63.04	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
117.00	169.20	11.37	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
117.00	169.20	11.37	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
117.00	169.20	11.37	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
119.00	169.20	11.01	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
120.00	169.20	10.05	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
121.00	169.20	9.18	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
122.00	169.20	8.31	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
123.00	169.20	7.44	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
124.00	169.20	6.57	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
125.00	169.20	5.70	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
126.00	169.20	4.83	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
127.00	169.20	3.96	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
128.00	169.20	3.09	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
129.00	169.20	2.22	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
130.00	169.20	1.35	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
131.00	169.20	0.48	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
132.00	169.20	-0.39	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
133.00	169.20	-1.26	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
134.00	169.20	-2.13	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
135.00	169.20	-3.00	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
136.00	169.20	-3.87	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
137.00	169.20	-4.74	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
138.00	169.20	-5.61	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
139.00	169.20	-6.48	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
140.00	169.20	-7.35	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
141.00	169.20	-8.22	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
142.00	169.20	-9.09	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
143.00	169.20	-9.96	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
144.00	169.20	-10.83	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
145.00	169.20	-11.70	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
146.00	169.20	-12.57	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
147.00	169.20	-13.44	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
148.00	169.20	-14.31	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
149.00	169.20	-15.18	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
150.00	169.20	-16.05	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
151.00	169.20	-16.92	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
152.00	169.20	-17.79	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
153.00	169.20	-18.66	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
154.00	169.20	-19.53	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
155.00	169.20	-20.40	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
156.00	169.20	-21.27	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
157.00	169.20	-22.14	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
158.00	169.20	-23.01	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
159.00	169.20	-23.88	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
160.00	169.20	-24.75	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
161.00	169.20	-25.62	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867
162.00	169.20	-26.49	66.20	89.63	60.20	92.60	61.91	90.21	137.47	169.7867

Table with multiple columns of numerical data, organized in rows and columns. The data appears to be a detailed ledger or account book entry.



375-00	149-20	18-44	63-27	78-56	661-33	92-77	671-07	130-57	1-3-57	20-807	19-2-27
376-00	149-20	15-14	60-22	76-66	667-27	75-76	670-34	111-55	1-2-57	20-807	19-2-27
377-00	149-20	11-03	60-01	80-52	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
378-00	149-20	7-21	58-77	90-35	66-117	75-76	670-34	111-55	1-2-57	20-807	19-2-27
379-00	149-20	5-01	64-56	75-65	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
380-00	149-20	7-13	60-10	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
381-00	149-20	11-03	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
382-00	149-20	12-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
383-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
384-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
385-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
386-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
387-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
388-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
389-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
390-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
391-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
392-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
393-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
394-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
395-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
396-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
397-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
398-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
399-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27
400-00	149-20	14-09	60-01	66-53	67-46	75-76	670-34	111-55	1-2-57	20-807	19-2-27

Account No.	Balance	Debit	Credit	Balance
573.00				
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423.00	55.25	189.17	61.73	57.35	412.39	37.01	312.71	121.33	16.72	11.5665	18.91165
424.00	55.25	188.45	61.34	56.36	413.31	37.06	313.29	121.33	36.77	11.5665	18.91165
425.00	55.25	187.73	60.95	55.36	414.23	37.11	313.87	121.33	36.77	11.5665	18.91165
426.00	55.25	187.01	60.56	54.36	415.15	37.17	314.45	121.33	36.77	11.5665	18.91165
427.00	55.25	186.29	60.17	53.36	416.07	37.23	315.03	121.33	36.77	11.5665	18.91165
428.00	55.25	185.57	59.78	52.36	416.99	37.29	315.61	121.33	36.77	11.5665	18.91165
429.00	55.25	184.85	59.39	51.36	417.91	37.35	316.19	121.33	36.77	11.5665	18.91165
430.00	55.25	184.13	59.00	50.36	418.83	37.41	316.77	121.33	36.77	11.5665	18.91165
431.00	55.25	183.41	58.61	49.36	419.75	37.47	317.35	121.33	36.77	11.5665	18.91165
432.00	55.25	182.69	58.22	48.36	420.67	37.53	317.93	121.33	36.77	11.5665	18.91165
433.00	55.25	181.97	57.83	47.36	421.59	37.59	318.51	121.33	36.77	11.5665	18.91165
434.00	55.25	181.25	57.44	46.36	422.51	37.65	319.09	121.33	36.77	11.5665	18.91165
435.00	55.25	180.53	57.05	45.36	423.43	37.71	319.67	121.33	36.77	11.5665	18.91165
436.00	55.25	179.81	56.66	44.36	424.35	37.77	320.25	121.33	36.77	11.5665	18.91165
437.00	55.25	179.09	56.27	43.36	425.27	37.83	320.83	121.33	36.77	11.5665	18.91165
438.00	55.25	178.37	55.88	42.36	426.19	37.89	321.41	121.33	36.77	11.5665	18.91165
439.00	55.25	177.65	55.49	41.36	427.11	37.95	321.99	121.33	36.77	11.5665	18.91165
440.00	55.25	176.93	55.10	40.36	428.03	38.01	322.57	121.33	36.77	11.5665	18.91165
441.00	55.25	176.21	54.71	39.36	428.95	38.07	323.15	121.33	36.77	11.5665	18.91165
442.00	55.25	175.49	54.32	38.36	429.87	38.13	323.73	121.33	36.77	11.5665	18.91165
443.00	55.25	174.77	53.93	37.36	430.79	38.19	324.31	121.33	36.77	11.5665	18.91165
444.00	55.25	174.05	53.54	36.36	431.71	38.25	324.89	121.33	36.77	11.5665	18.91165
445.00	55.25	173.33	53.15	35.36	432.63	38.31	325.47	121.33	36.77	11.5665	18.91165
446.00	55.25	172.61	52.76	34.36	433.55	38.37	326.05	121.33	36.77	11.5665	18.91165
447.00	55.25	171.89	52.37	33.36	434.47	38.43	326.63	121.33	36.77	11.5665	18.91165
448.00	55.25	171.17	51.98	32.36	435.39	38.49	327.21	121.33	36.77	11.5665	18.91165
449.00	55.25	170.45	51.59	31.36	436.31	38.55	327.79	121.33	36.77	11.5665	18.91165
450.00	55.25	169.73	51.20	30.36	437.23	38.61	328.37	121.33	36.77	11.5665	18.91165
451.00	55.25	169.01	50.81	29.36	438.15	38.67	328.95	121.33	36.77	11.5665	18.91165
452.00	55.25	168.29	50.42	28.36	439.07	38.73	329.53	121.33	36.77	11.5665	18.91165
453.00	55.25	167.57	50.03	27.36	440.00	38.79	330.11	121.33	36.77	11.5665	18.91165
454.00	55.25	166.85	49.64	26.36	440.92	38.85	330.69	121.33	36.77	11.5665	18.91165
455.00	55.25	166.13	49.25	25.36	441.84	38.91	331.27	121.33	36.77	11.5665	18.91165
456.00	55.25	165.41	48.86	24.36	442.76	38.97	331.85	121.33	36.77	11.5665	18.91165
457.00	55.25	164.69	48.47	23.36	443.68	39.03	332.43	121.33	36.77	11.5665	18.91165
458.00	55.25	163.97	48.08	22.36	444.60	39.09	333.01	121.33	36.77	11.5665	18.91165
459.00	55.25	163.25	47.69	21.36	445.52	39.15	333.59	121.33	36.77	11.5665	18.91165
460.00	55.25	162.53	47.30	20.36	446.44	39.21	334.17	121.33	36.77	11.5665	18.91165
461.00	55.25	161.81	46.91	19.36	447.36	39.27	334.75	121.33	36.77	11.5665	18.91165
462.00	55.25	161.09	46.52	18.36	448.28	39.33	335.33	121.33	36.77	11.5665	18.91165
463.00	55.25	160.37	46.13	17.36	449.20	39.39	335.91	121.33	36.77	11.5665	18.91165
464.00	55.25	159.65	45.74	16.36	450.12	39.45	336.49	121.33	36.77	11.5665	18.91165
465.00	55.25	158.93	45.35	15.36	451.04	39.51	337.07	121.33	36.77	11.5665	18.91165
466.00	55.25	158.21	44.96	14.36	451.96	39.57	337.65	121.33	36.77	11.5665	18.91165
467.00	55.25	157.49	44.57	13.36	452.88	39.63	338.23	121.33	36.77	11.5665	18.91165
468.00	55.25	156.77	44.18	12.36	453.80	39.69	338.81	121.33	36.77	11.5665	18.91165
469.00	55.25	156.05	43.79	11.36	454.72	39.75	339.39	121.33	36.77	11.5665	18.91165
470.00	55.25	155.33	43.40	10.36	455.64	39.81	340.00	121.33	36.77	11.5665	18.91165
471.00	55.25	154.61	43.01	9.36	456.56	39.87	340.58	121.33	36.77	11.5665	18.91165
472.00	55.25	153.89	42.62	8.36	457.48	39.93	341.16	121.33	36.77	11.5665	18.91165
473.00	55.25	153.17	42.23	7.36	458.40	39.99	341.74	121.33	36.77	11.5665	18.91165
474.00	55.25	152.45	41.84	6.36	459.32	40.05	342.32	121.33	36.77	11.5665	18.91165
475.00	55.25	151.73	41.45	5.36	460.24	40.11	342.90	121.33	36.77	11.5665	18.91165
476.00	55.25	151.01	41.06	4.36	461.16	40.17	343.48	121.33	36.77	11.5665	18.91165
477.00	55.25	150.29	40.67	3.36	462.08	40.23	344.06	121.33	36.77	11.5665	18.91165
478.00	55.25	149.57	40.28	2.36	463.00	40.29	344.64	121.33	36.77	11.5665	18.91165
479.00	55.25	148.85	39.89	1.36	463.92	40.35	345.22	121.33	36.77	11.5665	18.91165
480.00	55.25	148.13	39.50	0.36	464.84	40.41	345.80	121.33	36.77	11.5665	18.91165

511-00	149-22	6-65	77-10	667-11	84-64	473-56	135-52	101-91	75-9866	149-738A
512-00	145-22	6-76	75-10	661-10	83-11	649-55	136-12	109-77	70-8413	149-739A
513-00	145-22	7-26	77-56	657-16	76-15	642-74	137-77	111-53	70-7131	149-739B
514-00	149-22	7-36	74-01	653-53	71-20	640-10	137-32	117-40	70-7357	149-739C
515-00	149-22	8-02	72-00	650-25	70-35	640-12	138-19	117-30	70-7352	149-739D
516-00	149-22	8-21	70-35	649-13	70-53	639-18	138-27	118-57	70-7311	149-739E
517-00	145-22	10-10	71-20	646-23	71-30	637-51	140-01	119-63	70-7300	149-739F
518-00	149-22	11-07	73-01	643-59	70-59	635-33	142-22	119-65	70-6355	149-739G
519-00	149-22	13-35	75-71	640-30	70-56	635-06	143-11	119-66	70-7322	149-739H
520-00	145-22	14-50	74-11	638-06	70-11	633-11	143-11	119-66	70-7310	149-739I
521-00	145-22	15-04	70-67	631-04	70-07	625-00	145-51	114-60	70-7417	149-739J
522-00	149-22	15-28	70-31	633-17	70-31	625-08	146-16	114-60	70-7691	149-739K
523-00	149-22	15-30	71-71	636-36	70-98	625-08	146-16	114-60	70-7375	149-739L
524-00	149-22	15-31	72-58	639-06	70-54	624-29	147-20	119-65	70-7375	149-739M
525-00	145-22	15-12	73-29	642-36	70-44	624-29	147-20	119-65	70-8270	149-739N
526-00	149-22	15-17	73-58	642-36	70-44	624-29	147-20	119-65	70-8270	149-739O
527-00	149-22	15-17	73-58	642-36	70-44	624-29	147-20	119-65	70-8270	149-739P
528-00	145-22	13-65	72-05	646-39	73-42	624-29	147-20	119-65	70-8270	149-739Q
529-00	145-22	12-11	73-01	646-39	73-42	624-29	147-20	119-65	70-8270	149-739R
530-00	149-22	12-21	73-01	646-39	73-42	624-29	147-20	119-65	70-8270	149-739S
531-00	149-22	11-30	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739T
532-00	149-22	10-36	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739U
533-00	149-22	10-36	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739V
534-00	149-22	10-41	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739W
535-00	149-22	10-24	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739X
536-00	149-22	10-10	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739Y
537-00	149-22	10-31	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739Z
538-00	149-22	10-52	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AA
539-00	149-22	10-79	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AB
540-00	149-22	11-08	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AC
541-00	145-22	11-31	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AD
542-00	149-22	11-54	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AE
543-00	149-22	11-75	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AF
544-00	149-22	11-75	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AG
545-00	149-22	11-75	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AH
546-00	149-22	12-01	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AI
547-00	149-22	11-94	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AJ
548-00	149-22	11-72	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AK
549-00	149-22	11-15	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AL
550-00	149-22	12-12	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AM
551-00	149-22	12-01	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AN
552-00	149-22	12-01	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AO
553-00	149-22	9-23	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AP
554-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AQ
555-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AR
556-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AS
557-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AT
558-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AU
559-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AV
560-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AW
561-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AX
562-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AY
563-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739AZ
564-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BA
565-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BB
566-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BC
567-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BD
568-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BE
569-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BF
570-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BG
571-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BH
572-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BI
573-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BJ
574-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BK
575-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BL
576-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BM
577-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BN
578-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BO
579-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BP
580-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BQ
581-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BR
582-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BS
583-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BT
584-00	149-22	9-65	74-01	647-02	73-08	624-29	147-20	119-65	70-8270	149-739BU

637.00	55.25	199.78	47.48	51.22	318.63	32.70	325.60	136.60	60.97	13.5372	169.0339
640.00	55.25	200.77	56.76	50.75	319.41	32.16	325.33	135.33	60.31	13.5364	169.0668
641.00	55.25	201.76	65.74	49.66	317.71	31.25	321.71	123.12	59.85	13.5351	169.0972
642.00	55.25	203.06	63.63	64.56	316.73	31.26	321.46	123.66	59.40	13.5343	169.1266
643.00	55.25	203.76	61.95	64.05	315.71	29.85	318.35	121.66	57.80	13.5327	169.1548
644.00	55.25	202.47	60.26	64.04	314.66	27.91	315.25	119.24	56.73	13.5312	169.1816
645.00	55.25	200.17	58.76	64.04	313.16	26.47	312.35	117.33	55.92	13.5297	169.2076
646.00	55.25	198.17	57.57	50.52	311.56	25.36	310.25	115.95	55.09	13.5282	169.2326
647.00	55.25	196.99	56.77	51.75	310.00	24.96	308.70	114.95	54.70	13.5269	169.2566
648.00	55.25	191.19	56.17	53.32	309.00	24.47	307.53	114.29	54.19	13.5259	169.2792
650.00	55.25	187.36	56.05	51.25	303.16	24.47	305.53	112.22	52.68	13.5247	169.3072
651.00	55.25	186.31	56.50	60.94	303.11	25.26	305.5	114.36	53.03	13.5232	169.3302
652.00	55.25	180.73	57.27	63.64	300.11	26.04	302.53	111.17	52.48	13.5217	169.3524
653.00	55.25	177.66	58.98	65.77	310.55	27.04	310.54	116.30	52.03	13.5202	169.3733
654.00	55.25	175.76	60.19	62.28	311.63	27.77	311.63	117.23	51.73	13.5187	169.3920
655.00	55.25	174.24	62.03	62.28	312.42	29.09	312.18	121.82	51.43	13.5172	169.4093
656.00	55.25	173.64	64.21	64.55	314.48	30.56	321.77	126.83	51.13	13.5157	169.4261
657.00	55.25	174.35	66.54	67.92	316.00	32.06	324.27	131.77	50.82	13.5142	169.4423
658.00	55.25	175.98	68.78	66.76	317.20	33.17	326.15	135.68	50.51	13.5127	169.4581
659.00	55.25	174.94	69.77	68.91	318.25	34.02	327.90	138.76	50.20	13.5112	169.4733
660.00	55.25	181.98	50.59	62.98	310.30	34.57	325.06	130.41	49.89	13.5097	169.4881
661.00	55.25	185.65	51.39	60.80	319.66	34.98	325.39	131.98	49.58	13.5082	169.5029
662.00	55.25	180.54	51.69	58.22	320.24	35.15	325.61	132.57	49.27	13.5067	169.5176
663.00	55.25	194.58	51.33	58.61	320.56	36.31	328.41	137.87	48.96	13.5052	169.5324
664.00	55.25	198.02	50.22	53.24	320.29	36.11	328.69	139.44	48.65	13.5037	169.5472
665.00	55.25	200.04	49.00	51.22	320.51	35.58	328.69	139.44	48.34	13.5022	169.5620
666.00	55.25	202.71	47.79	49.83	319.57	35.26	323.43	136.43	48.03	13.5007	169.5768
667.00	55.25	206.55	46.16	48.61	319.33	31.96	321.41	131.58	47.72	13.4992	169.5916
668.00	55.25	204.98	64.80	47.65	310.13	30.25	321.68	129.17	47.41	13.4977	169.6064
669.00	55.25	203.21	61.54	47.39	316.88	29.79	320.60	124.16	47.10	13.4962	169.6212
670.00	55.25	201.21	61.28	47.76	315.61	29.67	320.28	126.98	46.79	13.4947	169.6360
671.00	55.25	201.37	39.41	48.61	313.56	27.66	317.60	116.07	46.48	13.4932	169.6508
672.00	55.25	198.93	38.41	50.07	312.50	28.67	316.67	113.13	46.17	13.4917	169.6656
673.00	55.25	195.91	37.57	52.09	311.12	28.03	315.65	110.04	45.86	13.4902	169.6804
674.00	55.25	193.66	37.35	54.18	310.64	25.88	315.33	107.50	45.55	13.4887	169.6952
675.00	55.25	190.07	37.35	56.63	310.13	25.98	315.29	105.50	45.24	13.4872	169.7100
676.00	55.25	184.95	37.66	58.91	310.04	26.98	315.29	103.50	44.93	13.4857	169.7248
677.00	55.25	184.69	38.15	60.71	310.17	26.45	315.55	111.27	44.62	13.4842	169.7396
678.00	55.25	182.50	39.77	62.24	310.67	27.60	316.05	112.69	44.31	13.4827	169.7544
679.00	55.25	181.09	40.17	63.32	311.33	27.88	316.84	117.31	44.00	13.4812	169.7692
680.00	55.25	180.10	43.55	64.05	312.23	29.82	317.79	120.71	43.69	13.4797	169.7840
681.00	55.25	179.78	43.39	64.23	313.56	30.66	320.08	124.07	43.38	13.4782	169.7988
682.00	55.25	180.40	45.01	63.71	314.21	31.12	321.03	128.63	43.07	13.4767	169.8136
683.00	55.25	181.68	46.17	63.02	314.79	31.97	321.99	131.18	42.76	13.4752	169.8284
684.00	55.25	182.65	46.93	62.40	316.44	32.93	322.24	132.79	42.45	13.4737	169.8432
685.00	55.25	184.29	47.33	61.34	316.50	32.59	322.39	135.65	42.14	13.4722	169.8580
686.00	55.25	186.36	47.75	60.02	316.33	32.66	322.57	138.55	41.83	13.4707	169.8728
687.00	55.25	188.98	48.10	58.64	317.60	33.07	322.76	141.29	41.52	13.4692	169.8876
688.00	55.25	191.25	48.58	56.93	317.62	33.64	322.68	145.18	41.21	13.4677	169.9024
689.00	55.25	193.55	49.58	56.93	317.62	33.64	322.68	145.18	40.90	13.4662	169.9172
690.00	55.25	195.07	46.86	54.30	317.30	32.40	322.32	148.22	40.59	13.4647	169.9320
691.00	55.25	196.24	66.24	53.60	317.30	32.40	322.32	151.33	40.28	13.4632	169.9468
692.00	55.25	196.82	65.84	52.94	316.78	31.54	321.17	150.61	39.97	13.4617	169.9616
693.00	55.25	197.17	64.82	52.55	316.28	31.07	320.22	150.21	39.66	13.4602	169.9764

787.00	185.20	14.31	45.78	89.96	689.23	35.85	667.98	651.58	197.77	276.9994	169.2757
788.00	185.20	14.29	45.51	91.75	688.24	35.85	667.36	651.54	197.39	276.9997	169.2757
789.00	185.20	14.27	45.25	93.55	687.25	35.85	666.74	651.50	197.00	276.9999	169.2757
790.00	185.20	14.25	45.00	95.34	686.26	35.85	666.12	651.46	196.62	276.9999	169.2757
791.00	185.20	14.23	44.75	97.14	685.27	35.85	665.50	651.42	196.24	276.9999	169.2757
792.00	185.20	14.21	44.50	98.94	684.28	35.85	664.88	651.38	195.86	276.9999	169.2757
793.00	185.20	14.19	44.25	100.74	683.29	35.85	664.26	651.34	195.48	276.9999	169.2757
794.00	185.20	14.17	44.00	102.54	682.30	35.85	663.64	651.30	195.10	276.9999	169.2757
795.00	185.20	14.15	43.75	104.34	681.31	35.85	663.02	651.26	194.72	276.9999	169.2757
796.00	185.20	14.13	43.50	106.14	680.32	35.85	662.40	651.22	194.34	276.9999	169.2757
797.00	185.20	14.11	43.25	107.94	679.33	35.85	661.78	651.18	193.96	276.9999	169.2757
798.00	185.20	14.09	43.00	109.74	678.34	35.85	661.16	651.14	193.58	276.9999	169.2757
799.00	185.20	14.07	42.75	111.54	677.35	35.85	660.54	651.10	193.20	276.9999	169.2757
800.00	185.20	14.05	42.50	113.34	676.36	35.85	659.92	651.06	192.82	276.9999	169.2757
801.00	185.20	14.03	42.25	115.14	675.37	35.85	659.30	651.02	192.44	276.9999	169.2757
802.00	185.20	14.01	42.00	116.94	674.38	35.85	658.68	650.98	192.06	276.9999	169.2757
803.00	185.20	13.99	41.75	118.74	673.39	35.85	658.06	650.94	191.68	276.9999	169.2757
804.00	185.20	13.97	41.50	120.54	672.40	35.85	657.44	650.90	191.30	276.9999	169.2757
805.00	185.20	13.95	41.25	122.34	671.41	35.85	656.82	650.86	190.92	276.9999	169.2757
806.00	185.20	13.93	41.00	124.14	670.42	35.85	656.20	650.82	190.54	276.9999	169.2757
807.00	185.20	13.91	40.75	125.94	669.43	35.85	655.58	650.78	190.16	276.9999	169.2757
808.00	185.20	13.89	40.50	127.74	668.44	35.85	654.96	650.74	189.78	276.9999	169.2757
809.00	185.20	13.87	40.25	129.54	667.45	35.85	654.34	650.70	189.40	276.9999	169.2757
810.00	185.20	13.85	40.00	131.34	666.46	35.85	653.72	650.66	189.02	276.9999	169.2757
811.00	185.20	13.83	39.75	133.14	665.47	35.85	653.10	650.62	188.64	276.9999	169.2757
812.00	185.20	13.81	39.50	134.94	664.48	35.85	652.48	650.58	188.26	276.9999	169.2757
813.00	185.20	13.79	39.25	136.74	663.49	35.85	651.86	650.54	187.88	276.9999	169.2757
814.00	185.20	13.77	39.00	138.54	662.50	35.85	651.24	650.50	187.50	276.9999	169.2757
815.00	185.20	13.75	38.75	140.34	661.51	35.85	650.62	650.46	187.12	276.9999	169.2757
816.00	185.20	13.73	38.50	142.14	660.52	35.85	650.00	650.42	186.74	276.9999	169.2757
817.00	185.20	13.71	38.25	143.94	659.53	35.85	649.38	650.38	186.36	276.9999	169.2757
818.00	185.20	13.69	38.00	145.74	658.54	35.85	648.76	650.34	185.98	276.9999	169.2757
819.00	185.20	13.67	37.75	147.54	657.55	35.85	648.14	650.30	185.60	276.9999	169.2757
820.00	185.20	13.65	37.50	149.34	656.56	35.85	647.52	650.26	185.22	276.9999	169.2757
821.00	185.20	13.63	37.25	151.14	655.57	35.85	646.90	650.22	184.84	276.9999	169.2757
822.00	185.20	13.61	37.00	152.94	654.58	35.85	646.28	650.18	184.46	276.9999	169.2757
823.00	185.20	13.59	36.75	154.74	653.59	35.85	645.66	650.14	184.08	276.9999	169.2757
824.00	185.20	13.57	36.50	156.54	652.60	35.85	645.04	650.10	183.70	276.9999	169.2757
825.00	185.20	13.55	36.25	158.34	651.61	35.85	644.42	650.06	183.32	276.9999	169.2757
826.00	185.20	13.53	36.00	160.14	650.62	35.85	643.80	650.02	182.94	276.9999	169.2757
827.00	185.20	13.51	35.75	161.94	649.63	35.85	643.18	650.00	182.56	276.9999	169.2757
828.00	185.20	13.49	35.50	163.74	648.64	35.85	642.56	650.00	182.18	276.9999	169.2757
829.00	185.20	13.47	35.25	165.54	647.65	35.85	641.94	650.00	181.80	276.9999	169.2757
830.00	185.20	13.45	35.00	167.34	646.66	35.85	641.32	650.00	181.42	276.9999	169.2757
831.00	185.20	13.43	34.75	169.14	645.67	35.85	640.70	650.00	181.04	276.9999	169.2757
832.00	185.20	13.41	34.50	170.94	644.68	35.85	640.08	650.00	180.66	276.9999	169.2757
833.00	185.20	13.39	34.25	172.74	643.69	35.85	639.46	650.00	180.28	276.9999	169.2757
834.00	185.20	13.37	34.00	174.54	642.70	35.85	638.84	650.00	179.90	276.9999	169.2757
835.00	185.20	13.35	33.75	176.34	641.71	35.85	638.22	650.00	179.52	276.9999	169.2757
836.00	185.20	13.33	33.50	178.14	640.72	35.85	637.60	650.00	179.14	276.9999	169.2757
837.00	185.20	13.31	33.25	179.94	639.73	35.85	636.98	650.00	178.76	276.9999	169.2757
838.00	185.20	13.29	33.00	181.74	638.74	35.85	636.36	650.00	178.38	276.9999	169.2757
839.00	185.20	13.27	32.75	183.54	637.75	35.85	635.74	650.00	178.00	276.9999	169.2757
840.00	185.20	13.25	32.50	185.34	636.76	35.85	635.12	650.00	177.62	276.9999	169.2757
841.00	185.20	13.23	32.25	187.14	635.77	35.85	634.50	650.00	177.24	276.9999	169.2757
842.00	185.20	13.21	32.00	188.94	634.78	35.85	633.88	650.00	176.86	276.9999	169.2757
843.00	185.20	13.19	31.75	190.74	633.79	35.85	633.26	650.00	176.48	276.9999	169.2757
844.00	185.20	13.17	31.50	192.54	632.80	35.85	632.64	650.00	176.10	276.9999	169.2757
845.00	185.20	13.15	31.25	194.34	631.81	35.85	632.02	650.00	175.72	276.9999	169.2757
846.00	185.20	13.13	31.00	196.14	630.82	35.85	631.40	650.00	175.34	276.9999	169.2757
847.00	185.20	13.11	30.75	197.94	629.83	35.85	630.78	650.00	174.96	276.9999	169.2757
848.00	185.20	13.09	30.50	199.74	628.84	35.85	630.16	650.00	174.58	276.9999	169.2757
849.00	185.20	13.07	30.25	201.54	627.85	35.85	629.54	650.00	174.20	276.9999	169.2757
850.00	185.20	13.05	30.00	203.34	626.86	35.85	628.92	650.00	173.82	276.9999	169.2757

B01.00	165.20	25.70	56.03	109.08	650.00	91.53	373.39	335.56	109.22	25.76	165.20
B02.00	145.20	24.04	56.93	110.09	653.00	90.55	644.65	367.63	109.22	25.76	145.20
B03.00	145.20	25.71	62.70	111.58	655.96	95.17	605.90	367.63	109.22	25.76	145.20
B04.00	145.20	26.52	61.16	110.00	658.01	95.17	616.02	372.70	109.22	25.76	145.20
B05.00	145.20	27.24	59.95	108.00	661.30	95.17	616.02	372.70	109.22	25.76	145.20
B07.00	145.20	20.20	38.87	106.06	665.76	78.10	671.22	310.73	109.22	25.76	145.20
B08.00	145.20	19.55	38.86	107.63	666.25	78.10	671.22	310.73	109.22	25.76	145.20
B09.00	145.20	17.57	39.23	102.66	665.65	78.10	671.22	310.73	109.22	25.76	145.20
B10.00	145.20	17.73	39.58	102.71	665.06	78.10	671.22	310.73	109.22	25.76	145.20
B11.00	145.20	21.75	39.60	106.57	663.58	78.55	675.87	315.66	109.22	25.76	145.20
B11.00	145.20	21.54	66.06	103.55	657.01	91.61	669.58	363.30	109.22	25.76	145.20
B12.00	145.20	20.92	58.47	92.26	631.67	112.60	661.22	610.83	127.66	20.92	145.20
B13.00	145.20	19.00	72.62	79.18	601.57	120.63	609.31	467.71	167.56	20.92	145.20
B14.00	145.20	17.71	70.35	71.92	580.55	136.17	596.52	467.71	167.56	20.92	145.20
B15.00	145.20	13.14	78.02	66.63	530.11	136.06	596.52	467.71	167.56	20.92	145.20
B17.00	145.20	3.55	78.19	60.26	510.21	136.06	596.52	467.71	167.56	20.92	145.20
B18.00	145.20	35.16	79.70	60.26	510.21	136.06	596.52	467.71	167.56	20.92	145.20
B19.00	145.20	36.14	79.02	58.71	517.45	136.70	591.00	480.78	160.56	20.92	145.20
B20.00	145.20	36.39	79.28	57.33	516.73	120.36	591.00	480.78	160.56	20.92	145.20
B21.00	101.52	361.36	79.63	57.68	779.00	100.62	393.33	393.71	160.00	20.92	101.52
B22.00	101.52	361.68	80.00	58.42	773.00	90.89	378.38	329.13	160.00	20.92	101.52
B23.00	81.14	363.64	80.28	60.73	360.11	63.11	173.59	262.68	90.00	20.92	81.14
B24.00	77.55	365.12	80.24	60.73	360.69	65.59	173.59	262.68	90.00	20.92	77.55
B25.00	77.55	366.04	79.91	60.00	360.00	65.66	176.06	250.55	77.55	20.92	77.55
B26.00	77.55	366.00	79.26	62.98	370.15	65.23	176.06	250.55	77.55	20.92	77.55
B26.00	77.55	366.00	78.77	66.02	370.15	65.23	176.06	250.55	77.55	20.92	77.55

10.00 10.00 280.00 3.00 1.00
 16.7350 - 169.5255 3.0000 2092628.00 2095998.50
 17.9111 - 168.9143 40.0000 6230.00 6260.00
 19.9171 - 168.9201

871.00	77.55	315.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
872.00	77.55	316.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
873.00	77.55	317.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
874.00	77.55	318.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
875.00	77.55	319.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
876.00	77.55	320.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
877.00	77.55	321.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
878.00	77.55	322.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
879.00	77.55	323.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
880.00	77.55	324.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
881.00	77.55	325.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
882.00	77.55	326.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
883.00	77.55	327.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
884.00	77.55	328.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
885.00	77.55	329.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
886.00	77.55	330.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
887.00	77.55	331.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
888.00	77.55	332.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
889.00	77.55	333.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
890.00	77.55	334.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
891.00	77.55	335.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
892.00	77.55	336.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
893.00	77.55	337.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
894.00	77.55	338.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
895.00	77.55	339.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
896.00	77.55	340.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
897.00	77.55	341.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
898.00	77.55	342.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
899.00	77.55	343.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09
900.00	77.55	344.97	79.67	63.59	170.45	69.33	106.33	25.25	76.26	2.25	190.09

881.00	72.55	137.87	76.67	56.66	322.73	62.77	330.76	233.59	71.13	12.75	15.15
882.00	72.55	232.56	66.63	50.62	332.73	62.77	332.73	235.57	71.13	12.75	15.15
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892.00	72.55	133.65	61.11	91.55	329.27	62.77	330.27	245.27	71.13	12.75	15.15
893.00	72.55	119.91	61.33	96.66	337.55	62.77	338.55	246.24	71.13	12.75	15.15
894.00	72.55	106.38	61.52	102.86	347.55	62.77	348.55	247.21	71.13	12.75	15.15
895.00	72.55	92.80	61.71	100.63	352.83	62.77	353.81	248.18	71.13	12.75	15.15
896.00	72.55	79.30	61.77	100.81	360.83	62.77	361.81	249.15	71.13	12.75	15.15
897.00	72.55	67.01	61.66	99.05	369.83	62.77	370.81	250.12	71.13	12.75	15.15
898.00	72.55	56.15	61.57	93.82	377.83	62.77	378.81	251.09	71.13	12.75	15.15
899.00	72.55	46.95	61.41	87.95	385.83	62.77	386.81	252.06	71.13	12.75	15.15
900.00	72.55	38.08	62.13	80.42	393.83	62.77	394.81	253.03	71.13	12.75	15.15
901.00	72.55	30.06	62.85	72.33	399.83	62.77	400.81	254.00	71.13	12.75	15.15
902.00	72.55	22.86	63.52	66.16	404.83	62.77	405.81	254.97	71.13	12.75	15.15
903.00	72.55	16.86	64.15	61.02	408.83	62.77	409.81	255.94	71.13	12.75	15.15
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905.00	72.55	7.86	65.33	55.68	416.83	62.77	417.81	257.88	71.13	12.75	15.15
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907.00	72.55	2.86	66.44	50.67	424.83	62.77	425.81	259.82	71.13	12.75	15.15
908.00	72.55	0.86	66.96	49.83	428.83	62.77	429.81	260.79	71.13	12.75	15.15
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913.00	72.55	76.34	69.10	45.54	448.83	62.77	449.81	265.64	71.13	12.75	15.15
914.00	72.55	89.13	68.11	44.54	452.83	62.77	453.81	266.61	71.13	12.75	15.15
915.00	72.55	101.33	66.52	43.54	456.83	62.77	457.81	267.58	71.13	12.75	15.15
916.00	72.55	116.25	65.59	42.55	460.83	62.77	461.81	268.55	71.13	12.75	15.15
917.00	72.55	127.20	65.07	41.55	464.83	62.77	465.81	269.52	71.13	12.75	15.15
918.00	72.55	140.37	64.06	40.55	468.83	62.77	469.81	270.49	71.13	12.75	15.15
919.00	72.55	154.63	63.03	39.54	472.83	62.77	473.81	271.46	71.13	12.75	15.15
920.00	72.55	166.83	62.51	38.54	476.83	62.77	477.81	272.43	71.13	12.75	15.15
921.00	72.55	179.07	62.39	37.54	480.83	62.77	481.81	273.40	71.13	12.75	15.15
922.00	72.55	192.67	62.35	36.54	484.83	62.77	485.81	274.37	71.13	12.75	15.15
923.00	72.55	206.66	62.35	35.54	488.83	62.77	489.81	275.34	71.13	12.75	15.15
924.00	72.55	212.73	62.30	34.54	492.83	62.77	493.81	276.31	71.13	12.75	15.15

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17.9120 -168.9200 60.0000 8270.00 7260.00
17.9122 -168.9214

REFERENCES

1. "DAMP - Station 12 Tracking Comparison." R. Bachinsky, Internal Correspondence. 25 January 1963
2. S. Horowitz and others; "Riometer Measurements"; Project 6.8, Operation Dominic. Fish Bowl Series, POR-2027; Stanford Research Institute, Menlo Park, California

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